

June 1959

# MINERALOGICAL ABSTRACTS

Volume 14 - No. 2

EDITED BY J. PHEMISTER

PUBLISHED JOINTLY BY  
THE MINERALOGICAL SOCIETY OF GREAT BRITAIN AND THE MINERALOGICAL SOCIETY OF AMERICA  
LONDON - 1959

Annual Subscription for four numbers, Post Free, \$9 : £3 3s.



## MINERALOGICAL ABSTRACTS : COMMITTEE OF MANAGEMENT

*Mineralogical Society of Great Britain :*

PROF. C. E. TILLEY (*Chairman*)

DR. G. F. CLARINGBULL DR. W. CAMPBELL SMITH

DR. M. H. HEY PROF. J. H. TAYLOR (*Treasurer*)

*Mineralogical Society of America :*

PROF. L. G. BERRY (*Chairman*)

MISS M. E. MROSE

PROF. A. PABST

*Editor :*

DR. JAMES PHEMISTER

*Hon. Asst. Editor :*

DR. P. A. SABINE

*Editorial Assistant :*

DR. AVERIL M. LYSAGHT

## ORGANISERS OF ABSTRACTS

*Great Britain :*

DR. R. A. HOWIE,

Geological Department,

The University,

Manchester, 13.

*America :*

PROF. L. G. BERRY,

Queen's University,

Kingston,

Ontario.

*Australia :* DR. J. MACANDREW, Mineragraphic Investigations, University of Melbourne, Carlton N.3, Victoria.

*Belgium :* DR. R. VAN TASSEL, Institut Royal des Sciences Naturelles, Brussels.

*Czechoslovakia :* PROF. J. NOVÁK, Charles University, Albertov 6, Praha 2.

*Denmark :* DR. HARRY MICHEELSON, Mineralogisk Museum, Østervoldgade 7, Copenhagen.

*Egypt :* DR. E. M. EL SHAZLY, Geological Survey, Dawawin, Cairo.

*Finland :* DR. VLADI MARMO, Outukumpu Oy, Malmink 16, Helsinki.

*India :* DR. A. P. SUBRAMANIAM, Geological Survey of India, 27 Chowringhee, Calcutta.

*Netherlands :* DR. P. C. ZWAAN, Rijksmuseum van Geologie en Mineralogie, van der Werffpark 1, Leiden.

*New Zealand :* DR. W. A. WATTERS, Geological Survey, P.O. Box 368, Lower Hutt, North Island.

*Norway :* PROF. I. W. OFTEDAL, Institutt for Geologi, Universitetet, Oslo.

*South Africa :* PROF. E. S. W. SIMPSON, Dept. of Geology, University of Capetown.

*Spain :* DR. M. FONT-ALTABA, Dept. Cristalografía y Mineralogía, Universidad, Barcelona.

*Sweden :* PROF. SVEN HJELMQVIST, Mineralogisk-Geologiska Institution, Universitet, Lund.



# MINERALOGICAL ABSTRACTS

## VOLUME 14

NUMBER 2, JUNE 1959

### CONTENTS

	Page		Page
Abstracts ... ..	i	Gemstones ... ..	118
Index of authors ... ..	ii	Geochemistry ... ..	122
Age determination and isotope mineralogy ... ..	81	Meteorites and tektites ... ..	126
Apparatus and techniques ... ..	83	Mineral data ... ..	134
Book notices ... ..	88	New minerals ... ..	139
Early minerals ... ..	91	Physical properties ... ..	142
Crystal structure ... ..	100	Rock-forming minerals and petrology ... ..	144
Economic minerals and ore deposits ... ..	105	Topographical mineralogy ... ..	155
Experimental mineralogy ... ..	114	Various ... ..	156

### ABSTRACTORS

Arman, E. (E.Å-n.), <i>Sweden</i>	Jeffries, C. D. (C.D.J.), <i>U.S.A.</i>	Sandréa, A. (A.S.), <i>France</i>
Bee, A. L. (A.L.A.), <i>U.S.A.</i>	Jérémie, E. (E.J.), <i>France</i>	Servos, K. (K.S.), <i>U.S.A.</i>
Andrews, G. F. (G.F.A.), <i>Gt. Britain</i>	Konta, J. (J.K.), <i>Czechoslovakia</i>	Spencer, L. J. (L.J.S.), <i>Gt. Britain</i>
Assett, W. A. (W.A.B.), <i>U.S.A.</i>	Lambert, R. StJ. (R.StJ.L.), <i>Gt. Britain</i>	Swineford, A. (A.Sw.), <i>U.S.A.</i>
Beler, B. H. (B.H.B.), <i>U.S.A.</i>	Lepp, H. (H.L.), <i>U.S.A.</i>	Taylor, S. R. (S.R.T.), <i>Gt. Britain</i>
Brown, G. M. (G.M.B.), <i>Gt. Britain</i>	Ljunggren, P. (P.Lggn.), <i>Sweden</i>	Taylor, W. H. (W.H.T.), <i>Gt. Britain</i>
Butler, J. R. (J.R.B.), <i>Gt. Britain</i>	Mackenzie, R. C. (R.C.M.), <i>Gt. Britain</i>	Thoreau, J. (J.Th.), <i>Belgium</i>
Bombs, D. S. (D.S.C.), <i>New Zealand</i>	MacKenzie, W. S. (W.S.M.), <i>Gt. Britain</i>	Tomkeieff, S. I. (S.I.T.), <i>Gt. Britain</i>
Bears, T. (T.D.), <i>Gt. Britain</i>	Marmo, V. (V.M.), <i>Finland</i>	Van Tassel, R. (R.V.T.), <i>Belgium</i>
Bloor, P. (P.F.), <i>Netherlands</i>	Mélon, J. (J.M.), <i>Belgium</i>	Wadsworth, W. J. (W.J.W.), <i>Gt. Britain</i>
Bont-Altaba, M. (M.F.-A.), <i>Spain</i>	Mitchell, R. S. (R.S.M.), <i>U.S.A.</i>	Watters, W. A. (W.A.W.), <i>New Zealand</i>
Bredriksson, K. (K.F.), <i>Sweden</i>	Mumpton, F. A. (F.A.M.), <i>U.S.A.</i>	Wayland, R. G. (R.G.W.), <i>U.S.A.</i>
By, P. (P.G.), <i>Gt. Britain</i>	Nicholls, G. D. (G.D.N.), <i>Gt. Britain</i>	Welin, E. (E.W.), <i>Sweden</i>
Criffitts, W. R. (W.R.G.), <i>U.S.A.</i>	Oftedal, I. W. (I.W.O.), <i>Norway</i>	Wells, R. G. (R.G.Wls.), <i>U.S.A.</i>
Cagemann, F. (F.d.H.), <i>Norway</i>	Overweel, C. J. (C.J.O.), <i>Netherlands</i>	Winchell, H. (H.W.), <i>U.S.A.</i>
Cale, W. E. (W.E.H.), <i>Canada</i>	Pabst, A. (A.P.), <i>U.S.A.</i>	White, W. A. (W.A.Wh.), <i>U.S.A.</i>
Camilton, P. K. (P.K.H.), <i>U.S.A.</i>	Phemister, J. (J.Ph.), <i>Gt. Britain</i>	Zussman, J. (J.Z.), <i>Gt. Britain</i>
Cardy, J. A. (J.A.H.), <i>U.S.A.</i>	Plas, L. v. d. (L.P.), <i>Netherlands</i>	Zwaan, P. C. (P.C.Z.), <i>Netherlands</i>
Coppin, R. A. (R.A.Hp.), <i>U.S.A.</i>	Preston, J. (J.P.), <i>Gt. Britain</i>	
Cowie, R. A. (R.A.H.), <i>Gt. Britain</i>	Richter, D. H. (D.H.R.), <i>U.S.A.</i>	

## INDEX OF AUTHORS

- AALOE A., 131  
 ABDULLA, M. A., 156  
 ABRAHAMS, S. C., 104  
 AFANASIEV, G. D., 123  
 AGRINIER, H., 86  
 AKAAD, A. M., 159  
 AKAAD, M. K., 159  
 AKAZA, I., 85  
 AKIMOTO, S., 142, 143  
 ALBERS, J. P., 109  
 ALDRICH, D. G., 93  
 ALEIXANDRE, V., 93  
 ALLEN, MRS. F., 155  
 ALLEN, R. D., 157  
 ALLEN, V. T., 147  
 ALMOND, M., 142  
 ALPER, A. M., 144  
 AMCHISLAVSKAYA, A. G., 99  
 AMELINCKX, S., 118  
 AMES, L. L., 93  
 AMORÓS, J. L., 91  
 AMSTUTZ, G. C., 82, 118  
 ANCION, CH., 112  
 ANDERSON, B. W., 88, 121  
 ANDERSSON, L. H., 87  
 ANON., 85, 111, 117  
 APPLIEDORN, C. R., 160  
 ARAMAKI, S., 142  
 ARNOULD, P., 112  
 ARSENYEVA, R. V., 115  
 ASSARSSON, G., 115  
 ASTAPOVICH, I. S., 129  
 AUBREY, K. V., 122  
 AXELROD, J. M., 135  
  
 BAKER, G., 131, 132  
 BAKR, M. Y., 98  
 BALASHOV, V., 101  
 BALSLEY, J. R., 143  
 BANFIELD, A. F., 152  
 BARNES, V. E., 132, 133  
 BARRER, R. M., 96, 116, 117, 156  
 BÁRTA, R., 156  
 BARTH, T. F. W., 148  
 BARTHOLOMÉ, P., 109, 145  
 BARTOSHINSKY, Z. V., 122  
 BASELGA Y RECARTE, A., 131  
 BEALS, C. S., 131  
 BEALS, R. J., 84  
 BEATTIE, I. R., 117  
 BEHRE, C. H., *Jr.*, 152  
 BELIKOVA, N. N., 161  
 BELSHÉ, J. C., 143  
 BELVIANES, M., 89  
 BELYAEV, Y. I., 86  
 BENTOR, Y. K., 111  
 BERNARD, H., 107  
 BÉTHUNE, P. DE, 154  
 BEZSMERTNAYA, M. S., 106  
 BINGHAM, J. P., 110  
 BLACKETT, P. M. S., 143  
 BLIX, R., 140  
 BLOOM, H., 85  
 BOBKOV, N. A., 122  
 BOERSMA, S. L., 93  
 BOND, R. D., 87  
 BONDAREVA, A. M., 138  
 BONEV, N., 126  
  
 BONTINCK, W., 118  
 BORISENOK, L. A., 86  
 BOURGUIGNON, P., 107  
 BOWEN, N. L., 89  
 BOWIE, S. H. U., 105  
 BOYLE, R. W., 125  
 BRADLEY, W. F., 96  
 BRAGG, SIR L., 118  
 BREEBAART, A. J., 120  
 BRÈTÈQUE, P. DE LA, 86  
 BRINDLEY, G. W., 94  
 BRINDLEY, J. C., 151  
 BROECKER, W. S., 83  
 BROTZEN, O., 110  
 BROWN, D. F., 85  
 BROWN, G. M., 150  
 BROWN, J. C., 120  
 BRYNJÓLFSSON, A., 143  
 BUCHANAN, J. R., 93  
 BUDDINGTON, A. F., 143  
 BUDNIKOV, P. P., 162  
 BUERGER, M. J., 83, 144  
 BULDAKOV, V. V., 123  
 BURBAGE, F. J., 84  
 BURCKHARDT, C. E., 112  
 BURKE, K., 159  
 BURRI, C., 89  
 BUSING, W. R., 103  
 BUTLER, B. S., 108  
 BYERS, A. R., 125  
 BYSTRÓM, A.-M., 98  
  
 CAILLÈRE, S., 91, 92  
 CALEMBERT, A., 112  
 CALEMBERT, L., 107  
 CALLAGHAN, E., 113  
 CANDLIN, R., 103  
 CARL, J. D., 118  
 CARROLL, D., 83  
 CARRON, M. K., 135  
 CARSTENS, H., 147, 151  
 CASEY, J. N., 111  
 CASSIDY, W. A., 132  
 CASTAING, R., 131  
 CHAKRAVARTY, S. C., 111  
 CHALMERS, R. A., 88  
 CHAYES, F., 104, 153  
 CHERDYNTZEV, V. V., 82  
 CHILDS, M. S., 108  
 CHISHOLM, E. O., 125  
 CHRIST, C. L., 104, 105  
 CHUKHROV, F. V., 138  
 CLARK, J. R., 105  
 CLARK, R. E. D., 85  
 CLEGG, J. A., 142, 143  
 CLINCH, I., 84  
 CLINE, F., 104  
 COCHRAN, W., 100  
 COHEN, A. J., 133  
 COHN, V. H., 88  
 COLLINSON, D. W., 142  
 COMPTON, R. R., 158  
 CONCHA, S. DE LA, 112  
 COOK, R. L., 84  
 CORMAK, A. M., 100  
 CORMIER, R. F., 133  
 CORRENS, C. W., 92  
 COURTRIGHT, J. H., 109  
 CREER, K. M., 142  
  
 CROWELL, A. D., 158  
 CURWEN, H. C., 85  
  
 DAS, M. SANKAR, 88  
 DAVIDSON, C. F., 122  
 DAVIES, D. R., 117  
 DAVIES, K. A., 150  
 DEAN, J. A., 89  
 DEKEYSER, W., 118  
 DEMUMBRUM, L. E., 95  
 DESTAS, A., 89  
 DEUTSCH, E. R., 143  
 DE VORE, G. W., 156  
 DE VRIES, R. C., 117  
 DICKEY, P. A., 113  
 DIORIO, A. F., 104  
 DIVARI, N. B., 127  
 DOBROKHOTOV, M. N., 141  
 DODD, C. G., 91  
 DOELL, R. R., 143  
 DOESTCHE, J., 112  
 DOMAREV, V. S., 109  
 DONOHUE, J., 103, 104  
 DOUGLAS, A. S., 100  
 DOUGLAS, G. V., 113  
 DREIZIN, R. L., 129  
 DREVER, H. I., 146, 151  
 DU BOIS, P. M., 143  
 DUPUIS, J., 86  
 DUPUIS, T., 86  
 DUSCHATKO, R. W., 158  
 DUWAYNE, M. A., 94  
 DYAKONOVA, M. I., 128  
  
 EATON, J. P., 152  
 EBERT, K. H., 86  
 ECKELMANN, F. D., 82  
 EDER, T., 98  
 EHMANN, W. D., 133  
 EINARSSON, T., 143  
 EITEL, W., 89  
 ELISEEV, E. N., 137  
 ELLIS, A. J., 157  
 ELSTON, W. E., 156  
 EMARA, S. H., 121  
 EMELEUS, C. H., 123  
 ENGINEER, B. B., 111  
 ENIKEEV, M. R., 137  
 EPPLER, W. F., 119, 120  
 ERMILOVA, L. P., 138  
 ERSHOVA, Z. P., 161  
 ESKIN, A. S., 154  
 ESQUEVIN, J., 91  
 EVANS, H. T., *Jr.*, 104, 105  
 EVERITT, C. W. F., 143  
 EYGENEV, I., 126  
 EXLEY, C. S., 123  
  
 FABRE, J., 158  
 FAHEY, J. J., 147  
 FAIRBAIRN, H. W., 133  
 FAIRCHILD, P., 113  
 FALCONER, J. D., 117  
 FALINI, F., 112  
 FAUST, G. T., 93, 113  
 FEDOROVA, V. A., 82  
 FEIGL, F., 84  
 FERGUSON, R. B., 103  
 FINCH, G. I., 100  
  
 FINLAYSON, D. M., 144  
 FISCHER, R. B., 86  
 FISCHMEISTER, H. F., 103  
 FLEMING, C. A., 159  
 FLINT, R. F., 83  
 FLORENSKY, K. P., 127  
 FOLINSBEE, R. E., 81  
 FONTBOTÉ, J. M., 97  
 FONTON, S. S., 127  
 FREDRIKSSON, K., 131  
 FRIEDMAN, I., 132, 133  
 FUJIWARA, T., 135  
 FURCRON, A. S., 130  
 FUTERGENDLER, S. I., 121  
 FYFE, W. S., 88, 116  
  
 GABRIELSON, O., 102, 140  
 GAINES, G. L., *Jr.*, 157  
 GALE, W. A., 83  
 GARD, J. A., 140  
 GARRELS, R. M., 158  
 GARSON, M. S., 90  
 GASS, I. G., 153  
 GATTOW, G., 103  
 GAULT, H. R., 91  
 GELLER, S., 104  
 GIANNINI, W. F., 155  
 GIGLIO, M., 103  
 GILVARAY, J. J., 131  
 GINZBURG, A. I., 136  
 GINZBURG, I. I., 90, 124  
 GINZBURG, I. V., 138  
 GJELSVIK, T., 112  
 GLAESER, R., 94  
 GNEVUSHEV, M. A., 121, 122  
 GODOVNIKOV, A. A., 106  
 GOLD, T., 132  
 GOLDSTEIN, D., 84  
 GOLDSZTAUB, S., 94  
 GOLDSZTEIN, M., 125  
 GONT, J., 147  
 GONZÁLEZ GARCIA, F., 97  
 GOOCH, E. O., 155  
 GOODMAN, N. R., 113  
 GORDIENKO, V. V., 137  
 GORTER, E. W., 143  
 GORZHEVSKY, D. I., 106  
 GOTO, M., 115  
 GOWER, J. A., 136  
 GRAHAM, J. W., 143  
 GRAHAM, K. W. T., 143  
 GRANGE, L. I., 90  
 GREGG, S. J., 91  
 GREIG, D., 144  
 GRIFFITHS, D. H., 143  
 GROMOVA, T. S., 82  
 GROSSMAN, I. G., 113  
 GROSVALD, M. G., 152  
 GÜBELIN, E. J., 119, 120, 121  
 GUILLEMIN, C., 89  
 GUPTA, A. K. S., 84  
 GUTIÉRREZ RIOS, E., 97  
 GUY, M. J., 84  
  
 HAAS, M., 100  
 HADJHOANNOU, T. P., 88  
 HAIGH, G., 142  
 HALL, W. J., *Jr.*, 125  
 HALES, A. L., 143



- LL, W. E., 109  
 MILTON, J., 149  
 MILTON, W. B., 159  
 NAHAN, J., 114  
 NNA, D. L., 118  
 NSON, A. W., 104  
 RADA, Z., 115  
 RDY, C. T., 130  
 RKER, R. I., 115  
 RRIS, W. F., 159  
 SEGAWA, S., 148  
 SHIMOTO, Y., 136  
 UPTMAN, H., 104  
 YASHI, H., 95, 135  
 YDEN, R. J., 81  
 ZEL, K. V., 87  
 ZELL, J. R. T., 110  
 CHT, F., 125  
 GEMANN, F., 92  
 IDE, F., 128  
 ENDERSON, E. P., 130  
 ENIN, S., 91, 92, 94  
 ENMI, K., 135  
 ENRIQUES, ÅKE, 114  
 ERBERT, P., *Jr.*, 108  
 ERT, W., 92  
 ERZOG, L. F., 133  
 LL, J. E., 131  
 LL, K. J., 91  
 ELMQVIST, S., 151  
 ODGE, T. W., 131  
 OLSE, W. T., 101  
 OLTEDAHL, H., 98  
 OLWERDA, J. G., 132  
 ONDA, S., 135  
 ONJO, G., 92  
 OOVER, C. D., 95  
 OSKING, K. F. G., 85  
 OWES, V. R., 121  
 OWIE, R. A., 154  
 UANG, W. T., 153  
 URLBUT, C. S., 139  
 YTÖNEN, K., 105, 140  
  
 NOVICI, V., 112  
 GLE, D., 155  
 GRAM, B., 135  
 VING, E., 142, 143  
 HIKAWA, Y., 142  
 ANOV, K. P., 150  
 ANOV, V. V., 125, 161  
 WASAKI, M., 145  
  
 JACKSON, M. L., 94  
 AEGER, J. C., 142  
 AFFE, H. W., 82  
 AHNS, R., 119  
 AKOB, R., 89  
 AMES, R. W., 88  
 EDLICKA, J. F., 155  
 EDWAB, J., 123  
 EFFERY, P. M., 81  
 EFFS, D. N., 124  
 EENSEN, K. J., 81  
 EENSEN, M. L., 156  
 OHNSTON, R., 146  
 ONES, D. A., 103  
 ONES, H. A., 111  
 ONES, T., 84  
  
 ADENSKY, A. A., 138  
 AKITANI, S., 95, 96, 144  
  
 KALOUSEK, G. L., 116  
 KANEKO, K., 111  
 KARLE, J., 104  
 KARUNAKARAN, C., 111  
 KATO, A., 135  
 KEAR, D., 107, 161  
 KELLER, J. E., 119  
 KENAWI, M., 122  
 KENNEDY, G. C., 83  
 KENNY, A. D., 88  
 KHITAROV, N. I., 114, 115  
 KHEBNIKOVA, Z. V., 99  
 KIBA, T., 85  
 KINKEL, A. R., *Jr.*, 109  
 KING, A. G., 85  
 KING, R. F., 143  
 KIRIYAMA, R., 116  
 KISSINGER, H. E., 157  
 KITAGAKI, R., 116  
 KITAMURA, N., 92  
 KOBAYASHI, K., 143  
 KOCHETKOVA, S. N., 82  
 KOCZY, F. F., 125  
 KODAMA, H., 136  
 KOENIGSWALD, G. H. R. v., 133, 134  
 KOHMAN, T. P., 132, 133  
 KOIZUMI, M., 116  
 KOKKOROS, P. A., 102  
 KOLOMENSKY, V. D., 128  
 KÖNIG, H., 86  
 KONOPICKY, K., 92  
 KOPAL, Z., 133  
 KORZHINSKY, D. S., 89, 162  
 KOUVO, O., 162  
 KOVDA, V. A., 99  
 KRINOV, E. L., 126, 127, 128, 129, 131  
 KRISHNA RAO, J. S. R., 111  
 KRISHNASWAMY, S., 111  
 KUDRYAKOVA, V. A., 106  
 KUELME, F. J., 148  
 KULBICKI, G., 100  
 KULP, J. L., 82, 122  
 KULSTAD, R. O., 113  
 KUN, N. DE, 107  
 KUNZE, G., 101  
 KURATH, S. F., 158  
 KURBANOVA, N. Z., 126  
 KUZNETZOVA, L., 126  
 KVASHA, L. G., 128  
 KWAWUK, S.-W., 88  
  
 LACY, W. C., 109  
 LAMAR, J. E., 113  
 LANGLEY, D. A., 116  
 LAYMAN, F. G., 102  
 LEBEDEV, E. B., 115  
 LECHNER, K., 112  
 LEE, D. E., 139  
 LEE, H., 121  
 LEGRAYE, M., 153  
 LEHMANN, H., 91  
 LEONARD, F. C., 130  
 LEVANDO, E. P., 137  
 LEVY, H. A., 103  
 LHOEST, A., 107  
 LIPSON, J., 81  
 LITZAREV, M. A., 144  
 LIZÁUR, J., 112  
 LJUNGGREN, P., 112, 124, 162  
  
 LOOPSTRA, L. H., 103  
 LOTHIAN, G. F., 89  
 LOUGHNAN, F. C., 99  
 LOUGHON, J., 112  
 LOVERING, T. S., 160  
 LOW, P. F., 94  
 LUND, E. H., 159  
 LUNDEGÅRDH, P. H., 153  
 LYAKHOVICH, V. V., 152  
  
 MACAR, P., 112  
 MCCONAHAY, W. C., 119  
 MCCONNELL, D., 101  
 MACDONALD, G. A., 152  
 MACDONALD, G. J. F., 156  
 MACGILLAVRY, C. H., 103  
 MCGREGOR, D., 113  
 MACHIN, J. S., 118  
 MACKAY, A. M., 85  
 MCKEOWN, P. J. A., 83  
 MCKIE, D., 159  
 McLACHLAN, D., *Jr.*, 101  
 McMILLAN, N. J., 99  
 MACNEIL, F. S., 135  
 MCQUARRIE, M., 117  
 MADHAVA MENON, V. P., 88  
 MAGASREVVY, J., 98  
 MAGUIRE, S. G., *Jr.*, 92  
 MAHADEVAN, C., 111  
 MAHAJAN, B. S., 119  
 MAJUMDAR, A. J., 117  
 MALMSTADT, H. V., 88  
 MARCIN, E. J., 111  
 MARKHININ, E. K., 161  
 MARTIN, J. G. M., 120  
 MARTIN, R. T., 92  
 MARTIN-VIVALDI, J. L., 97  
 MASON, B. H., 132, 147  
 MASTER, J. M., 111  
 MATZKO, J. J., 82  
 MAYERS, D. E., 119  
 MEIER, W. M., 156  
 MELNIK, Y. P., 106  
 MÉLON, J., 102, 134  
 MÉRING, J., 94, 95  
 MERRIAM, R., 132  
 MERRITT, L. L., 89  
 MEYER, A., 154  
 MEYROWITZ, R., 141  
 MIHAMA, K., 92  
 MILLER, S. J., 104  
 MILLMAN, A. P., 143  
 MILTON, C., 135  
 MITCHELL, B. J., 86  
 MITCHELL, G. H., 160  
 MITSUDA, T., 96  
 MIYASHIRO, A., 144, 145, 149  
 MOHR, P. A., 112  
 MOLEVA, V. A., 138  
 MOREY, G. W., 116, 158  
 MORIMOTO, N., 105  
 MORRIS, R. C., 113  
 MOSEBACH, R., 157  
 MOUNTAIN, E. D., 140  
 MROSE, M. E., 104  
 MUIR, I. D., 146  
 MUKAE, M., 113  
 MURAOKA, M., 111  
 MURDOCH, J., 139  
 MURRAY, P., 96  
 MURTHY, A. R. V., 84  
 MURTHY, M. V. N., 85  
  
 MURTHY, T. K. S., 84  
 MURTY, Y. G. K., 111  
 MUTA, K., 108  
 MUTHUSWAMI, T. N., 139  
  
 NAGATA, T., 143  
 NAGELL, R. H., 113  
 NAGLE, R. A., 84  
 NAIDENOV, B. M., 82  
 NAIRN, A. E. M., 143  
 NAKAHIRA, M., 96  
 NAKAYAMA, F. S., 94  
 NAMNANDORZH, O., 129  
 NARAYAN, V. A., 84  
 NARAYANASWAMI, S., 111  
 NAZAROV, P. P., 137  
 NEFEDOV, E. I., 138  
 NIIZEKI, N., 144  
 NISHIHARA, H., 110  
 NISHIMURA, S., 136  
  
 OBERLIN, A., 92  
 O'BRIEN, M. V., 112  
 OFFMAN, P. E., 106  
 OHMACHI, H., 111  
 O'KEEFE, J. A., 132  
 OMAR, M., 122  
 ONTOREV, D. O., 138  
 ORGANOVA, N. I., 144  
 ORR, P. C., 83  
 OSBORN, E. F., 117  
 OSTROM, M. E., 125  
 OTSUKA, H., 135  
 OZIMA, M., 143  
  
 PALAVEEV, T., 99  
 PALLISTER, J. W., 110  
 PANEQUE, G., 97  
 PARENNOVA, E. I., 98  
 PARKER, T. W., 91  
 PARRY, J. H., 143  
 PARWAL, A., 83  
 PASTOR, M., 112  
 PATEL, A. R., 121, 122  
 PATTERSON, E. M., 151  
 PAVLENKO, L. I., 86, 123  
 PAVLOV, N. V., 106  
 PAVNE, C. J., 120  
 PEARSON, G. R., 124  
 PEGAU, A. A., 88  
 PEHRMAN, G., 97  
 PÉLISSONNIER, H., 112  
 PELLETIER-DOISY, C., 155  
 PENSAR, G., 87  
 PERETTI, E. A., 116  
 PERLOFF, A., 104  
 PERRY, S. H., 130  
 PETERSSON, H., 131  
 PÉZERAT, H., 95  
 PHELPS, G. W., 92  
 PINO VAZQUEZ, C. DEL, 97  
 PINSON, W. H., *Jr.*, 133  
 PLAS, L. VAN DER, 149  
 PLÖCHINGER, B., 112  
 POKRZYWNICKI, J. E., 126  
 POLDERVAART, A., 144, 153, 158  
 POLINKOVSKAYA, A. I., 162  
 POLYAKOVA, O. P., 108  
 PORRENGA, D. H., 92  
 POSNER, A. S., 104  
 POUBA, Z., 112  
 POULSEN, A. O., 112



POVARENNYKH, A. S., 142, 158  
PRASADA RAO, G. H. S. V., 111

QUAIDE, W., 100

RADONOVA, T. G., 137  
RAMOVIĆ, M., 126  
RAO, M. R. A., 84  
RAUSSELL-COLOM, J. A., 97  
RAY, J. A., 155  
RAY, S., 91  
REAY, J. S. S., 96  
REDAELLI, L. L., 151  
REED, J. C., *Jr.*, 158  
REED, J. J., 107, 159  
REICHEN, L. E., 84  
RENTZEFERIS, P. J., 102, 104  
REYNA, J. G., 111, 112  
REYNOLDS, J. H., 81  
REYNOLDS, M. B., 81  
REYNOLDS, R. R., 108  
RICHARD, K., 109  
RIDGE, J. D., 89  
RIETZ, T. DU, 149  
RILEY, J. M., 84  
RILEY, J. P., 87  
RINEHART, J. S., 131  
RING, C. E., 86  
RINGBORN, A., 87  
ROACH, C. H., 141  
RODRIGUEZ, M. C., 93  
ROGACHEV, D. L., 138  
RONOV, A. B., 99, 124  
ROSE, R. L., 145  
ROTHERHAM, D. C., 123  
ROTHSTEIN, A. T. V., 154  
ROUTHIER, P., 112  
ROY, B. C., 111  
ROY, D. M., 115  
ROY, R., 115, 116, 117  
RUDENKO, S. A., 144  
RÜE, E. A. DE LA, 112  
RUNCORN, S. K., 142, 143  
RUNDKVIST, D. V., 107  
RUNKLES, J. R., 94  
RUSTOM, M., 94

SAHAMA, T. G., 105, 140, 146  
SAHORES, J., 117  
SALKOVITZ, E. I., 101  
SANCHEZ-MEJORADA, P., 108  
SAND, L. B., 93, 117  
SARDAROV, S. S., 84  
SASS, R. L., 103  
ŠAUMAN, Z., 87  
SAVAGE, H. E. F., 111  
SAWHNEY, B. L., 94  
SAXBY, D. B., 113

SCHARBERT, H. G., 148  
SCHEERE, J., 97, 98  
SCHINKEL, H., 87  
SCHMIDT, W., 92  
SCHNEIDERHÖHN, H., 89  
SCHUHKNECHT, W., 87  
SCHUILLING, R. D., 162  
SCHWITE, H. E., 93  
SCOON, J. H., 146  
SCOTT, A. D., 94  
SEARLE, E. J., 152  
SEE, G. T., 99  
SEITZ, F., 118  
SEKI, Y., 149  
SEN, S., 88  
SERDYUCHENKO, D. P., 138  
SHAMRAI, I. A., 106  
SHAUB, B. M., 155  
SHERWOOD, W. C., 155  
SHILLIBEER, H. A., 81  
SHILOV, V. N., 161  
SHIMIZU, Y., 143  
SHISHKIN, N. N., 140  
SHUKLA, K. D., 111  
SIGURGEIRSSON, T., 143  
SINDEEVA, N. D., 126  
SILVA, S. J. DA, 112  
SINHA, A. P. B., 100  
SINHA, K. P., 100  
SKERTCHLY, A. R. B., 84  
SKINNER, B. J., 108  
SLICHTER, L. B., 143  
SLIVKO, M. M., 124  
SMALES, A. A., 86, 145  
SMITH, G. F. H., 88  
SMITH, T., 103  
SMITH, W. C., 90  
SOBOLEV, N. D., 148  
SOLOVIEV, A. T., 137  
SONDHI, V. P., 111  
SOROCHINSKAYA, V. I., 106  
SOSEDKO, A. F., 137  
SOSEDKO, T. A., 138  
SPEIGHT, R., 152  
STACE, H. C. T., 87  
STANKEVICH, L. O., 141  
STARKOV, N. P., 137  
ST. CLAIR, D., 152  
STEPHENS, E. A., 112  
STEPHENS, M. J., 91  
STERRETT, D. B., 120  
STEVENS, J. R., 81  
STONE, M., 87  
STONE, P., 150  
STRACZEK, J. A., 111  
STRUWE, H., 150  
STUBBS, P. H. S., 143  
STUCKEY, J. L., 114, 155  
STYUNKEL, T. B., 88

SUBRAMANYAM, M. R., 111  
SUDO, T., 95, 96, 135  
SUGISHITA, N., 85  
SUN, M.-S., 141  
SUTHERLAND, G. B. B. M., 100  
SUZUKI, J., 111

TAKABATAKE, A., 111  
TAKANO, Y., 83  
TAKÉUCHI, Y., 102  
TAMALE-SSALI, C. E., 85  
TANAKA, T., 84  
TARASOV, L. S., 82  
TAYLOR, H. F. W., 140  
TAYLOR, J. H., 108  
TAYLOR, K., 105  
TAYLOR, S. R., 123  
TAYLOR, W. H., 103  
TEIS, R. V., 82  
TEM, T., 98  
THOMAS, G. E., 160  
THOMAS, J. E., 87  
THOMAS, T. M., 160  
THOMPSON, M. E., 141  
TILLEY, C. E., 146, 153, 154  
TOLANSKY, S., 121, 122  
TOMIC, E., 125  
TOUSSAINT, J., 101, 102, 107, 134  
TRAILL, R. J., 103  
TRUYOLS, J., 97  
TRYGGVASON, T., 151  
TUGARINOV, A. I., 82  
TUNELL, G., 157  
TUREKIAN, K. K., 122  
TURNER, F. J., 88  
TUTTLE, O. F., 89  
TZEITLIN, S. G., 123

UBISCH, H. v., 83  
UKAI, Y., 136  
UREY, H. C., 133  
UYEDA, S., 143

VAASJOKI, O., 112  
VAES, J. F., 89  
VAINSTEIN, E. E., 123  
VANDERWILT, J. W., 108  
VAN TASSEL, R., 134  
VARSAVSKY, C. M., 132  
VASILIEVA, Z. V., 144  
VEMBAN, N. A., 111  
VENKATESH, V., 111  
VENTRIGLIA, U., 95  
VERHOOGEN, J., 88, 157  
VICKERS, W., 101  
VIDALE, R., 103  
VINCENT, E. A., 86, 145  
VINOGRAOV, A. P., 82, 123, 127  
VITOVSKAYA, I. V., 124,

VORMA, A., 139  
VOROBYEV, G. G., 129  
VUORELAINEIN, Y., 162

WAGER, L. R., 145  
WAKANABE, T., 135  
WALLEY, C. A., 88  
WALTON, J., 120  
WALTON, W. H., 89  
WÄNKE, H., 86  
WÄNNINEN, E., 87  
WARING, C. L., 82, 87  
WASSERBURG, G. J., 81  
WATERS, W. A., 160  
WEBER, R. H., 141  
WEBSTER, R., 120, 121  
WEINSTEIN, E. E., 86  
WEY, R., 94  
WEYL, P. K., 115  
WHITE, D. E., 160  
WHITE, J., 96  
WHITTAKER, E. J. W., 105  
WICKMAN, F. E., 83, 140  
WIEDEN, P., 98  
WIJKERSLOOTH, P. DE, 110  
WICKOX, R. E., 153  
WILDT, R., 131  
WILKINSON, J. F. G., 146  
WILLARD, H. H., 89  
WILLIS, B. T. M., 84  
WILLMAN, H. B., 108  
WILSON, C., 155  
WILSON, M. E., 159  
WINCHELL, H., 134  
WOODLAND, A. W., 112  
WORTHING, H. W., 87  
WRIGHT, A. E., 143  
WRIGHT, H. E., *Jr.*, 160

YAKIMETS, E. M., 88  
YAMADA, K., 116  
YARLOVA, E. A., 98  
YAVNEL, A. A., 127  
YEE, T. B., 118  
YODER, H. S., *Jr.*, 146  
YOUELL, R. F., 110  
YOUNG, E. J., 134  
YUDIN, I. A., 128  
YUKUTAKE, T., 143

ZADOROZHNY, I. K., 127  
ZAVARITZKY, A. N., 89  
ZELENOV, K. K., 161  
ZIEGLER, G., 93  
ZIMOVETS, B. A., 99  
ZOTKIN, I. T., 128, 129  
ZWAAN, P. C., 120, 149  
ZYKOV, S. I., 82



# MINERALOGICAL ABSTRACTS

Vol. 14—No. 2 June 1959

## AGE DETERMINATION AND ISOTOPE MINERALOGY

**Wrens (J. R.) & Shillibeer (H. A.).** *Loss of argon from minerals and rocks due to crushing.* Proc. Geol. Assoc. Canada, 1956, **8**, 71–76.

Anomalous results in potassium–argon age determinations on feldspar–mica pairs are probably due to the loss of argon in originally homogeneous potash feldspar during metamorphic replacement by sodium-bearing solutions. The argon may be released during preparatory crushing. Mica should be used in preference to feldspars for this method of age determination. Where feldspars must be used, analyses should be repeated several months later to determine whether argon has been lost during crushing.

W. E. H.

**Reynolds (M. B.).** *Diffusion of argon in a potassium–lime–silica glass.* Journ. Amer. Ceram. Soc., 1957, **40**, 395–398, 3 figs.

Diffusion coefficients for bulk diffusion of argon in a potassium–lime–silica glass have been determined at temperatures in the range 308°C to 470°C by neutron activation and radioactive counting techniques. Argon diffusion is found to follow classical bulk diffusion theory. The values obtained are compared with those for helium and argon obtained by other investigators by use of the permeation technique.

W. A. B.

**Wasserburg (G. J.), Hayden (R. J.), & Jensen (Kenneth J.).**  *$^{40}\text{A}$ – $^{40}\text{K}$  dating of igneous rocks and sediments.* Geochim. Cosmochim. Acta, 1956, **10**, 153–165.

Potash-bearing minerals in the same rock (e.g. microcline, muscovite, albite) do not give the same  $^{40}\text{K}/^{40}\text{A}$  ratio because of differing losses of  $^{40}\text{A}$ . The muscovites examined have retained 85% and the microclines about 70% of their (diogenic) $^{40}\text{A}$ . Success in dating sediments using  $^{40}\text{K}/^{40}\text{A}$  ratios from authigenic potash minerals depends on the presence of inherited  $^{40}\text{A}$  and on a knowledge of the subse-

quent rate of loss of  $^{40}\text{A}$ . Further comparisons between good Pb–U ages and  $^{40}\text{A}/^{40}\text{K}$  ages are necessary before the argon method can be considered to be established.

J. R. B.

**Folinsbee (R. E.), Lipson (J.), & Reynolds (J. H.).** *Potassium–argon dating.* Geochim. Cosmochim. Acta, 1956, **10**, 60–68.

Micas retain  $^{40}\text{A}$  more completely than potash-feldspars; plagioclase retains even less  $^{40}\text{A}$  (relative to  $^{40}\text{K}$ ).  $^{40}\text{K}/^{40}\text{A}$  age results are tabulated for granitic rocks and their minerals from the Yellowknife subprovince of the N.W. part of the Canadian Shield (7 specimens) and the Sierra Nevada batholith of California (3 specimens), also for a meteorite and a Devonian sylvinite.  $\lambda_\beta$  is taken as  $0.503 \times 10^{-9}$  per year and  $\lambda_\kappa/\lambda_\beta$ , the branching ratio, as either 0.089 or 0.110.

J. R. B.

**Lipson (Joseph I.).** *K–A dating of sediments.* Geochim. Cosmochim. Acta, 1956, **10**, 149–151, 2 figs.

$^{40}\text{K}/^{40}\text{A}$  ages have been determined for 13 minerals including 10 New Zealand glauconites. Data for the latter agree in general with their stratigraphical arrangement. An anomalous result for a Miocene glauconite indicates either that  $^{40}\text{A}$  has been inherited or that  $^{40}\text{A}$  has been lost to a greater degree in other glauconites in surface samples. The branching ratio,  $\lambda_\kappa/\lambda_\beta$ , is taken as 0.110. [M.A. 14–3, 4]

J. R. B.

**Jeffery (P. M.).** *The radioactive age of four Western Australian pegmatites by the potassium and rubidium methods.* Geochim. Cosmochim. Acta, 1956, **10**, 191–195.

It is known that Rb–Sr ages are 20–30% greater than U–Pb ages when  $^{87}\text{Rb}$  is taken to have a decay-constant of  $1.13 \times 10^{-11}$  per year. Rb–Sr ages are accordingly reduced by 20% before being compared with K–A ages obtained by



analysis of muscovite and microcline from 3 pegmatites, and lepidolite and microcline from a fourth. The K branching ratio is taken as  $0.10 \pm 0.01$  and the  $^{40}\text{K}$  decay-constant as  $0.56 \times 10^{-9}$  per year. Most of the  $^{40}\text{A}$  appears to have been retained in all but one of the muscovites; three microclines have, as expected, lost appreciable  $^{40}\text{A}$  but the fourth has retained nearly all its  $^{40}\text{A}$ . Further studies of suites of minerals from which U-Pb, K-A, and Rb-Sr ages can be determined should clarify the quantitative aspect of this type of measurement.

J. R. B.

[**Vinogradov (A. P.), Tugarinov (A. I.), Fedorova (V. A.), & Zykov (S. I.)**] Виноградов (А. П.), Тугаринов (А. И.), Федорова (В. А.), и Зыков (С. И.). Возраст Докембрийских Пород Украины. Сообщение 3. [*The age of Precambrian rocks of the Ukraine.*] Геохимия, Изд. Акад. Наук СССР. [Geochemistry, Publ. Acad. Sci. U.S.S.R.], 1957, **7**, 559-565.

A continuation of previous work which deals with determination, by the lead-uranium-thorium method, of the age of zircon and orthite extracted from syenites and granites. The most reliable results were obtained from the  $^{207}\text{Pb}/^{235}\text{U}$  ratio, the ages ranging from 1700 to 2080 million years. [M.A. **13**-137, 138, 499, 561, 565; **14**-2, 3] S. I. T.

[**Vinogradov (A. P.), Zykov (S. I.), & Tarasov (L. S.)**] Виноградов (А. П.), Зыков (С. И.), Тарасов (Л. С.). Изотопный состав свинца-примеси в рудах и минералах, как показатель генезиса и времени образования. [*Isotopic composition of lead-impurity in ores and minerals as an indicator of their genesis and time of formation.*] Геохимия, Изд. Акад. Наук СССР [Geochemistry, Publ. Acad. Sci. U.S.S.R.], 1958, **6**, 515-523.

Lead isotope ratios were determined in sulphide and other minerals from various ores of the U.S.S.R. The data thus obtained serve as a basis for comparing the genesis and the age of various ore deposits. The lead isotope ratios of cassiterites are anomalous, suggesting that minerals in which one can expect to find accessory radioactive minerals may be unsuitable for lead isotope determination.

S. I. T.

[**Naidenov (B. M.) & Cherdyntzev (V. V.)**] Найденов (Б. М.) и Чердынцев (В. В.). Изменение изотопного состава свинца при выделении из природных минералов. [*The change in the isotopic composition of lead on its extraction from natural minerals.*] Изв. Акад. Наук СССР, Сер. Геол. [Bull. Acad. Sci. URSS, Sér. Géol.], 1958, **5**, 40-49, 2 figs.

Experiments on the extraction of lead and other radiogenic elements from minerals have shown that certain elements or isotopes are extracted more easily than others. Thus the relative amounts of isotopes in extracts are different from those in the original minerals. Data from various minerals are given.

S. I. T.

[**Teis (R. V.), Gromova (T. S.), & Kochetkova (S. N.)**] Тейс (Р. В.), Громова (Т. С.) и Кочеткова (С. Н.). Изотопный состав природных фосфатов. [*The isotopic composition of natural phosphates.*] Доклады Акад. Наук СССР [C.R. Acad. Sci. URSS], 1958, **122**, 1057-1060, 2 figs.

An attempt was made to determine the isotope-exchange equilibrium between  $^{18}\text{O}$  in water and in phosphates by using a heavy phosphate of potassium and water enriched in heavy oxygen. Also heterogeneous exchange with carbon dioxide was studied by using a natural apatite. In the case of phosphates in solution the exchange was much slower than in the case of sulphates. In the case of carbon dioxide the exchange was still slower. Analysis shows that the content of  $^{18}\text{O}$  in natural phosphates is lower than in river water. The results do not suggest the possibility of using phosphates for palaeothermometry.

S. I. T.

[**Matzko (J. J.), Jaffe (H. W.), & Waring (C. L.)**] Lead-alpha age determinations of granitic rocks from Alaska. Amer. Journ. Sci., 1958, **256**, 529-539.

Age determinations based on data from separated zircons indicate one period of activity in south-eastern and east-central Alaska  $102 \pm 6 \times 10^6$ , and another  $55 \pm 6 \times 10^6$  years ago, correlated respectively with Middle Cretaceous and early Tertiary times. The 8 individual determinations are as follows: granite, Birch Creek, Ruby quadrangle, 53 m.y.; quartz-monzonite, Flat Creek, Iditarod quad., 49; quartz-monzonite, Chicken Creek, Iditarod quad., 60; monzonite, Nixon Ford Mines, Medfra quad., 58; leucosyenite, Mt. Fairplay, Yanacross quad., 103; granodiorite, Turner Lake Taku River quad., 93; diorite, Tolstoi Point, Craig C-2 quad., 103; granodiorite, Porcupine Creek, McCarthy quad., 105 m.y.

H. W.

[**Kulp (J. L.), Amstutz (G. G.), & Eckelmann (F. D.)**] Lead isotope composition of Peruvian galenas. Econ. Geol., 1957, **52**, 914-922.

Isotopic abundance ratios for lead from nineteen galena samples from the Tertiary hydrothermal mineralization of



central Peruvian Andes suggest their origin to be a homogeneous magma derived from an average crustal environment with regard to its U/Pb and Th/Pb ratios. The consistency of the lead isotopes through all zones of mineralization and over great vertical and horizontal extent is taken as further evidence against significant fractionation of these isotopes during transportation and deposition.

R. A. H.

**Roll (Dorothy).** *Zircon in a bentonite bed in Martinsburg shale at Fishers Hill, Virginia.* Virginia Journ. Sci., 1957, **8**, 331.

A zircon concentrate from bentonite near the base of the Martinsburg shale, at Fishers Hill, Shenandoah County, Virginia, gave an age of  $340 \pm 35$  m.y. using the total lead- $\alpha$  activity ratios. This age is within the range obtained for igneous rocks of Ordovician age using the same method.

R. S. M.

**Wal (A.), Ubisch (H. v.), & Wickman (F. E.).** *On the variations in the relative abundance of boron isotopes in nature.* Geochim. Cosmochim. Acta, 1956, **10**, 185-190, 1 fig.

28 tourmalines, selected to show widely differing parageneses, 4 axinites, and 11 other boron minerals were analysed for their  $^{11}\text{B}/^{10}\text{B}$  ratio; no variations were found (variations of a few parts per thousand would have been detected). 3 samples of sea water, however, gave  $^{11}\text{B}/^{10}\text{B}$  greater by 2% than in the minerals.

J. R. B.

**Broecker (Wallace S.) & Orr (Phil C.).** *Radiocarbon chronology of Lake Lahontan and Lake Bonneville.* Bull. Geol. Soc. America, 1958, **69**, 1009-1032, 10 figs.

Radiocarbon measurements on fresh-water carbonates were used to determine the absolute chronology of the two largest fossil lakes in the Great Basin. An estimate of the initial  $^{14}\text{C}/^{12}\text{C}$  ratio in the ancient fresh-water carbonates was made by measuring the  $^{14}\text{C}/^{12}\text{C}$  ratios in three samples of material presently forming in a similar environment. Error, due to exchange of carbon atoms in the sample with those in the surroundings after the formation of the mineral, was evaluated by computing the contamination due to the contaminated surface layer and that due to transfer by diffusion from the surface to the interior layers of the crystal. It was found possible to remove most of the contamination by acid leaching or thermal decomposition of the surface; such treatment gave results agreeing, within the error of measurement, with the calculated correction. The error of measurement due to systematic errors arising from exchange and low initial  $^{14}\text{C}$  concentration is considered to be less than 10%.

A. L. A.

**Flint (Richard F.) & Gale (W. A.).** *Stratigraphy and radiocarbon dates at Searles Lake, California.* Amer. Journ. Sci., 1958, **256**, 689-714.

Two deep lakes left sediments which in each case were buried under evaporites resulting from desiccation during a warm, dry period (including the present).  $^{14}\text{C}$  dates show that the present dry climate started about 10,000 years B.P. (=before present), and the preceding succession of wet, dry, and wet periods started about 23,000, 36,000, and 46,000 years B.P., respectively.

H. W.

## APPARATUS AND TECHNIQUES

### Optical, X-ray, and other apparatus

**akano (Y.).** *A spiral Weissenberg apparatus for X-ray analysis.* Min. Journ. [Japan], 1957, **2**, 143-150, 5 figs.

The apparatus records the reflections of several layers of the reciprocal lattice simultaneously on a single photograph.

J. Z.

**Keown (P. J. A.).** *A precision micro-thermostat for crystal X-ray studies.* Journ. Sci. Instruments, 1954, **31**, 271-273, 2 figs.

The furnace construction and temperature controlling circuit are described for a micro-thermostat used in connection with an X-ray single crystal spectrometer from

room temperature to above 700°C. Temperature fluctuations were less than  $\pm 0.02^\circ\text{C}$  at all temperatures up to 700°C, and the vertical temperature gradient had a maximum of  $+0.26^\circ\text{C}/\text{mm}$ .

R. A. H.

**Buerger (M. J.) & Kennedy (G. C.).** *An improved specimen holder for the focusing-type X-ray spectrometer.* Amer. Min., 1958, **43**, 756-757, 1 fig.

A specimen mount for a focusing X-ray spectrometer giving very low and steady background has been found. It is a quartz oscillator plate, BT cut, i.e.  $49^\circ$  from the  $c$  axis, subparallel to the (1011) crystal face. The scattered radiation from this mount is considerably less than that from a glass slide.

B. H. B.



**Skertchly (A. R. B.).** *Calculation of the macro absorption factor for a cylindrical specimen irradiated with a fine beam.* Acta Cryst., 1957, **10**, 535. J. Z.

**Beals (R. J.) & Cook (R. L.).** *Directional dilation of crystal lattices at elevated temperatures.* Journ. Amer. Ceram. Soc., 1957, **40**, 279-284, 1 pl., 7 figs.

A curved back-reflection camera which can maintain temperatures up to 1400°C is used to measure lattice parameters of crystals at elevated temperatures in order to determine their thermal expansion. These values are given for rutile, and for zinc-alumina and zinc-chrome spinels.

P. K. H.

**Burbage (F. J.) & Jones (Thorold).** *Measuring dichroism—some experiments.* Journ. Gemmology, 1957, **6**, 166-171.

A simple apparatus is described for measuring the strength of dichroism, using superimposed polaroid discs and absorption filters for selected wave-lengths. R. A. H.

**Willis (B. T. M.).** *An optical method of studying the diffraction from imperfect crystals. I. Modulated structures.* Proc. Roy. Soc., 1957, **239**, A, 184-191, 12 figs, 3 pls.

— *An optical method of studying the diffraction from imperfect crystals. II. Crystals with dislocations.* Ibid., 192-201, 10 figs, 2 pls. R. A. H.

**[Sardarov (S. S.)]** Сардаров (С. С.). Новый реактор для выделения и очистки радиогенного аргона. [A new reactor for extraction and purification of radiogenic argon.] Изв. Акад. Наук СССР, Сер. Геол. [Bull. Acad. Sci. URSS, Sér. Géol.], 1957, **4**, 108-112, 2 figs.

S. I. T.

#### Chemical, gravimetric and volumetric

**Glinch (I.) & Guy (Margaret J.).** *The extraction and absorptiometric determination of uranium as thiocyanate.* Analyst, 1957, **82**, 800-807.

U is extracted as thiocyanate from a solution containing EDTA at pH 3.5-3.9 into tributyl phosphate in CCl<sub>4</sub>, and the optical density is measured at 350 mμ. The removal of interfering elements and the application of the method to the determination of U in low-grade ores are discussed.

R. A. H.

**Reichen (L. E.).** *Use of ion exchange resins in the analysis of rocks and minerals. Separation of sodium and potassium.* Anal. Chem., 1958, **30**, 1948-1950.

Na and K are separated from other constituents silicates on a cation exchange column of Amberlite IR-12, the sample having been digested in an HF-H<sub>2</sub>SO<sub>4</sub> mixture. Results for U.S. Geol. Survey specimens G-1 and W-1 are Na<sub>2</sub>O 3.12, 2.05, K<sub>2</sub>O 5.70, 0.64 respectively. Other constituents (except Si) can be determined on the same portion of the sample. R. A. H.

**Nagle (R. A.) & Murthy (T. K. S.).** *An ion-exchange method for the separation of thorium from rare earths, and its application to monazite analysis.* Analyst, 1959, **82**, 37-41.

A method is described for the solution of monazite and the separation and determination of Th and rare earths using Amberlite IRA-400 (sulphate form) followed by oxalate precipitation. R. A. H.

**Gupta (Apurba Kumar Sen).** *Estimation of beryllium. I. A new rapid gravimetric method for its determination as beryl.* Journ. Indian Chem. Soc., 1957, **34**, 725-727.

The sample is fused with NaBF<sub>4</sub>, leached with hot water, the extract adjusted to a pH of 7.2 to 7.4, and Be is precipitated as BaBeF<sub>4</sub>. [M.A. **13**-323, 437, 571] R. A. H.

**Riley (J. M.).** *A rapid method for fluorimetric determination of beryllium.* U.S. Bur. of Mines (Dept. of Interior) 1957, Rep. Investigation, no. 5282, 9 pp. R. A. H.

**Feigl (Fritz) & Goldstein (David).** *Tests for aluminium and hydroxytriphenylmethane dyes.* Anal. Chem., 1957, **29**, 456-458.

Al in silicates may be detected in a 1 mg. sample after fusion with zinc chloride or attack by the normal methods. R. A. H.

**Murthy (A. R. Vasudeva), Narayan (V. A.), & Rao (M. R. A.).** *Determination of sulphide sulphur in minerals.* Analyst, 1956, **81**, 373-375.

The sulphides are reduced to H<sub>2</sub>S by hydriodic acid, the corresponding metal iodides forming complexes with excess HI and remaining in solution. The liberated H<sub>2</sub>S is determined iodimetrically after absorption by a suspension of cadmium hydroxide. R. A. H.

**Tanaka (T.).** *Analytical studies on masking reactions. VI. Analysis of ilmenite with sulphosalicylic acid.* Japan Analyst, 1957, **6**, 78-80.



Following fusion with potassium pyrosulphate, leaching in 5%  $\text{H}_2\text{SO}_4$ , and filtration, a portion of the filtrate is treated with  $\text{NH}_4\text{Cl}$ , sulphosalicylic acid, and  $\text{NH}_3\text{aq.}$  and adjusted to pH 8 to 9. The sulphides of Fe and Mn are precipitated with  $\text{H}_2\text{S}$  and separated from each other with  $\text{H}_2\text{O}_2$ ; Ti is precipitated by boiling the filtrate which has been further adjusted to pH > 9, and Al is precipitated as aluminate.

R. A. H.

**Maeda (T.), Akaza (I.), & Sugishita (N.).** *Rapid determination of inorganic sulphur in various forms, particularly in sulphide ores, by the tin(II)—strong phosphoric acid reduction method.* Bull. Chem. Soc. Japan, 1957, **30**, 972–975.

Full details are given for this method of determining S in sulphide ores; it is compared with Lunge's gravimetric method for sulphide ores; reproducibility is similar but the method here described gives slightly higher results which are believed to be more nearly correct. [M.A. 13–325]

R. A. H.

### Field and petrographical methods

**Mark (Robert E. D.) & Tamale-Ssali (G. E.).** *o-Dithiols in analysis. Part VIII. Use of the zinc complex of toluene-3:4-dithiol in the field testing of ores and minerals.* Analyst, 1959, **84**, 16–23.

This reagent is recommended for testing for Cu, Ag, Au, Sn, Pb, V, As, Sb, Bi, Mo, W, Se, Te, Mn, Fe, Co, Pt, and S in their ores and minerals. By carrying out simple procedures suited to field conditions most of these elements can usually be detected in the coarsely powdered mineral in a few minutes. Interferences are rare and usually can be avoided.

R. A. H.

**Dom (Harold).** *A field method for the determination of ammonium citrate-soluble heavy metals in soils and alluvium.* Econ. Geol., 1955, **50**, 533–541.

A cold extraction technique gives a positive test with soils or alluvium containing 100 p.p.m. of combined copper, iron, and lead.

R. A. H.

**MacKay (A. M.) & Brown (D. F.).** *Field method for detecting lithium.* The Precambrian, 1955, **28**, no. 7, 12.

A lithium-bearing rock or mineral will impart a red color to the flame when heated before an acetylene torch. A aluminium glass filter will remove the sodium light, per-

mitting the red to be seen, or the flame can be viewed through a hand spectroscope. [M.A. 14–9, 78]

W. R. G.

**Hosking (K. F. G.).** *Chemical tests on mineral streaks.* Mining Mag., 1957, **97**, 139–148, 1 fig.

The application of chemical tests to mineral streaks is recommended and the techniques employed are described. Various methods are discussed and practical details are given for the detection of specific ions and for the differentiation of certain minerals. The metals dealt with are Al, Sb, Ba, Sr, Bi, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mo, Ni, Ag, Te, W, U, V, and Zn.

R. A. H.

**Murthy (M. V. N.).** *An apparatus for hand-picking mineral grains.* Amer. Min., 1957, **42**, 694–696.

The apparatus makes use of a soft plastic water-pistol as a suction device for collecting grains through an intravenous needle and polyethylene tubing into a glass vial. [M.A. 12–23]

R. A. H.

**King (Alan G.).** *Technique for thinned polished sections.* Amer. Min., 1957, **42**, 689–694, 3 figs.

The techniques of thinning polished sections to allow a study of the relationships between transparent and opaque minerals are discussed. Plucking can be controlled by plastic impregnations and temperature control, while damage to the polished surface can be minimized by using slow lap speeds, fine abrasives, and gentle grinding.

R. A. H.

**Curwen (H. C.).** *A field method for the rapid estimation of the oxides of niobium and tantalum in black-sand concentrates.* Trans. Inst. Mining Metall., London, 1957, **66**, 39–41.

After fusion with  $\text{KHSO}_4$ , cooling, and the addition of tartaric acid the melt is dissolved in hot water and boiled with a small amount of dilute  $\text{H}_2\text{SO}_4$ . Following filtration, dilute HCl is added to the filtrate; this is then boiled to precipitate the bulk of the Nb and Ta which is finally ignited as  $(\text{Nb}, \text{Ta})_2\text{O}_5$ . The removal of interfering elements is discussed. [M.A. 13–76, 258]

R. A. H.

**Anon.** *Meteorite cutting.* Rocks and Minerals, 1958, **33**, 421–424, 2 figs.

This paper is concerned with various methods employed by the Smithsonian Astrophysical Observatory in the preparation of meteorites for detailed study.

R. S. M.



**Mass spectrographic, X-ray spectrographic, Various**

**Mitchell (B. J.).** *X-ray spectrographic determination of tantalum, niobium, iron, and titanium oxide mixtures, using simple arithmetic corrections for interelement effects.* Anal. Chem., 1958, **30**, 1894-1900, 9 figs.

The method is applicable to chemically prepared specimens of columbite or tantalite, etc. [M.A. **13-76**, 258]

R. A. H.

**Dupuis (Thérèse) & Dupuis (Jacques).** *L'analyse des roches dolomitiques par dosage thermogravimétrique simultané du calcium et du magnésium.* Mikrochim. Acta, 1958 (2), 186-196, 4 figs.

The carbonate is heated first at 500°C to give (MgO+CaCO<sub>3</sub>) and then at 900°C to give (MgO+CaO) until constant weight is attained. Several successive weighings to ensure constant weight at 500°C are also necessary and if a thermoanalysis curve is being recorded the material should be held at 500°-550°C for about 30 mins. to establish a plateau.

R. A. H.

**Ebert (K. H.), König (H.), & Wänke (H.).** *Eine neue Methode zur Bestimmung kleinster Uranmengen und ihre Anwendung auf die Urananalyse von Steinmeteoriten.* Zeits. Naturf., 1957, **12**, A, 763-765.

When uranium is irradiated by a neutron beam <sup>133</sup>Xe is produced to the extent of 6.5% of the U present. This xenon with a half-life of 5.27 days is separated and its activity measured. For the chondritic meteorites from Pultusk, Breitscheid, and Akaba the xenon method gave U contents of 1.20, 1.23 and  $0.82 \times 10^{-8}$  g/g respectively.

R. A. H.

**Agrinier (Henri).** *Détermination semi-quantitative du vanadium dans les sols par chromatographie ascendante sur papier.* C.R. Acad. Sci. Paris, 1958, **246**, 2761-2763.

Vanadium in soils is separated by a solvent of ammonia and oxygenated water and developed by 8-hydroxyquinoline. The sensitivity is of the order of a few p.p.m. and results obtained are compared with values obtained colorimetrically. For investigating the V content of uranium minerals prior separation of U by hexone is recommended. [M.A. **13-76**, 434]

R. A. H.

**Fischer (Robert B.) & Ring (Charles E.).** *Quantitative infrared analysis of apatite mixtures.* Anal. Chem., 1957, **29**, 431-434.

Fluorapatite is determined in hydroxyapatite with error of 1.5% or less of the fluorapatite content. R. A. H.

**Vincent (E. A.) & Smales (A. A.).** *The determination of palladium and gold in igneous rocks by radioactivation analysis.* Geochim. Cosmochim. Acta, 1956, **9**, 154-160.

A method is described for the estimation of Pd and Au with approximate sensitivity limits of 0.01 p.p.m. and 0.002 p.p.m. respectively. Diabase W-1 contains about 0.019 p.p.m. of both Pd and Au; granite G-1 contains less than 0.01 p.p.m. Pd and about 0.01 p.p.m. Au. J. R. B.

**Bretèque (Pierre de la).** *Gallium recovery from bauxite.* Journal of Metals, 1956, **8**, no. 11, 1528-1529, 1 tab. Translated and summarized from the book 'Études sur le Gallium' by the same author.

The report discusses research into the extraction of gallium from caustic solutions of the Bayer process under conditions which prevent modification of the solutions. The process developed consisted of submitting to electrolysis the sodium aluminate leaches after deposition of aluminum hydrate. Two-fold electrolysis removes and refines the gallium. Vanadium also is removed in the primary electrolysis as a precipitate of tetravalent vanadium hydrate. Certain other impurities, especially iron, are also removed from the caustic leach solutions. R. G. Wls.

**Borisenok (L. A.).** [Spectrographic determination of gallium in silicate rocks and minerals. Zhur. Anal. Khim. 1957, **12**, 704-707.] [Anal. Abstr., 1958, **5**, abstr. 291]

Ga is determined spectrographically using NaCl as a buffer, which allows one calibration curve to be used for all types of minerals, lowers the arc temperature, stabilizes the arc, reduces background intensity, and by reducing the intensity of the Fe line 2943.57Å raises the sensitivity for the determination of Ga by the Ga line 2943.64 ten-fold. Sn is introduced as internal standard using Sn 3034.1Å [M.A. **16-6**]

R. A. H.

**Weinstein (E. E.), Pavlenko (L. I.), & Belyaev (Y. I.).** *The use of radioactive isotopes in spectral analysis.* UNESCO NS/RIC/47, 1957, 23 pp.

The use of radioactive tracers has enabled the relationship between the intensity of a spectral line and the volatility of an element to be studied. The determination of Mo in silicate rocks was investigated and an improved procedure



given. The establishment of conditions to give results independent of the method of standard preparation and of chemical nature of the matrix is discussed. R. A. H.

**Worthing (C. L.), Worthing (H. W.), & Hazel (K. V.).** *Spectrochemical method for the determination of selenium.* Anal. Chem., 1958, **30**, 1504-1506.

Se in pyrite, chalcocite, or marcasite can be determined spectrographically with the aid of new shortwave radiation lines. The Se lines at 2039.85 and 2062.78 Å are enhanced by the addition of copper oxide to the sample. In the range 0.15 to 2% Se the accuracy is about 7% of the concentration. Results are given for 15 mineral samples. [M.A. 13-144, 434] R. A. H.

#### Photometric, spectrometric, colorimetric

**Worthing (J. P.).** *The rapid analysis of silicate rocks and minerals.* Anal. Chim. Acta, 1958, **19**, 413-428, 2 figs. The analysis is carried out in four parts. Si is determined spectrophotometrically by the molybdenum blue method using Ag crucibles and with metol as the reducing agent. Al is determined by the conventional procedure. Total Fe, Ti, Al, Mn, and P are determined spectrophotometrically, Ca and Mg are estimated with EDTA after the removal by ion exchange of interfering elements, and Na and K are estimated using a flame photometer.  $H_2O$  and  $CO_2$  are determined by a recently described rapid method [M.A. 14-5]. The accuracy is comparable with that for the best classical procedures, but the methods described are about 5-6 times as rapid. Results given for the standard rocks G-1 and W-1 (U.S. Geol. Survey) show satisfactory agreement with the reported analyses [M.A. 12-33, 264]: these methods have also been used successfully for the analysis of rocks containing up to 80%  $CaCO_3$ . R. A. H.

**Worthing (L. H.).** *Studies in the determination of silica. I. Spectrophotometric determination of silica as  $\alpha$ -silicomolybdate.* Acta Chem. Scandinavica, 1958, **12**, 495-502, 6 figs.

Previous methods for the determination of Si by the formation of silicomolybdate have not achieved the complete conversion of the unstable  $\beta$ -form to the stable  $\alpha$ -silicomolybdate. In a new procedure the silica solution is mixed with molybdate and heated on a steam bath for three hours, and the absorption is measured at 400 m $\mu$  at 20°C. The absorption is nearly constant over a pH range

1 to 4.3, but varies by approx. 2-3% per °C. The concentration of  $MoO_4^{2-}$  in the reagent is also critical. R. A. H.

**Šauman (Z.).** [Study of the conditions for the flame-photometric determination of sodium and potassium in silicates. Chem. Zvesti, 1957, **11**, 168-174.] Anal. Abstr., 1958, **5**, abstr. 2107.

The interference of Ca, Al, and Fe or Mg has been studied. An HF-HCl attack is recommended. [M.A. 13-144, 510] R. A. H.

**Stone (M.) & Thomas (J. E.).** *Flame photometric determination of calcium in silicate rocks.* Analyst, 1958, **83**, 691-694.

For rocks containing up to 2.5% CaO the Ca may be determined flame photometrically using an absorption filter, a correction being applied for the amount of Na present (50 p.p.m.  $Na_2O$  is equivalent to 1 p.p.m. CaO). Results are quoted for four samples of the Godolphin granite, Cornwall. [M.A. 13-144, 14-6] R. A. H.

**Bond (R. D.) & Stace (H. C. T.).** *The transmission characteristics of some interference filters for use in flame photometry.* Analyst, 1958, **83**, 679-683, 1 fig.

Several interference filters and one absorption filter were examined for errors caused in the flame photometric determination of Na by radiation emitted by Li, K, Rb, Cs, and Ca at wavelengths within incompletely suppressed transmission bands. It is concluded that although the magnitude of the interference may often be insignificant it could assume serious proportions in the determination of small amounts of Na in minerals containing large amounts of the other alkalis. [M.A. 13-144, 510] R. A. H.

**Schuhknecht (W.) & Schinkel (H.).** *Die flammenphotometrische Bestimmung von Calcium, Strontium und Barium nebeneinander.* Zeits. anal. Chem., 1958, **160**, 23-33, 1 fig.

A method is described by which, after being separated from heavy metals, alkali metals, phosphate and  $SiO_2$ , Ca, Sr, and Ba may be determined in a filter-type flame photometer with the elimination of mutual interference. [M.A. 13-510] R. A. H.

**Ringborn (A.), Pensar (G.), & Wänninen (E.).** *A complexometric titration method for determining calcium in the presence of magnesium.* Anal. Chim. Acta, 1958, **19**, 525-531, 4 figs.



In the presence of Mg, Ca is titrated complexometrically with ethyleneglycol-bis-aminoethylether-tetraacetic acid (EGTA) using Zincon+ZnX as indirect indicator. The colour change is very sharp. [M.A. 13-259, 434, 575, 14-5]

R. A. H.

**Malmstadt (H. V.) & Hadjiioannou (T. P.).** *Rapid and accurate automatic titration of calcium and magnesium in dolomites and limestones. Use of EDTA titrant and automatic derivative spectrophotometric end-point termination.* Anal. Chim. Acta, 1958, **19**, 563-569, 1 fig.

Ca is automatically titrated in the presence of Mg at pH 13 using Calcon as indicator [M.A. 13-259], and the total amount of Ca and Mg at pH 10 using Eriochrome black T as indicator. The method is simple, precise and accurate, and requires less than 5 minutes for both titrations.

R. A. H.

**Madhava Menon (V. P.) & Sankar Das (M.).** *The simultaneous spectrophotometric micro-determination of calcium and magnesium with Eriochrome black T and ethylenediaminetetra-acetic acid.* Analyst, 1958, **83**, 434-437.

A method is described which permits the individual determinations of Ca and Mg without their prior separation: it is based on the differences in the stabilities of the complexes of the metals with Eriochrome black T and with EDTA at the same pH. [M.A. 13-259, 434]

R. A. H.

**Styunkel' (T. B.) & Yakimets (E. M.).** *[Acid Chrome dark blue and Acid Chrome blue K as indicators in the complexometric determination of calcium.* Zavod. Lab., 1958, **24**, 23-25]. Anal. Abstr., 1958, **5**, abstr. 3275.

The use of these indicators instead of murexide enables Ca and Mg to be determined with EDTA on the same sample with the same indicator but at a different pH.

R. A. H.

**Kenny (A. D.) & Cohn (V. H.).** *Complexometric determination of calcium in the presence of magnesium.* Am. Chem., 1958, **30**, 1366-1368.

To raise the limit of interference from Mg in the EDT determination of Ca the pH should be 12.4 to 12.5. [M.A. 13-259, 434, 575]

R. A. H.

**Chalmers (Robert A.) & Walley (C. A.).** *A recording spectrophotometric titrimeter.* Analyst, 1957, **82**, 329-336.

An apparatus has been designed for the titration of microgram quantities by the automatic recording of the rate of change of optical density of the solution being titrated. It has been successfully used for the estimation of  $\text{CaCl}_2$  and  $\text{MgCl}_2$  with EDTA.

R. A. H.

**Kwauk (Sheau-Wei).** *Beryllon II as an indicator for complexometric titration.* Acta Chim. Sinica, 1958, **24**, 19-196.

The use of Beryllon II (8:1':8'-trihydroxy-1:2'-aznaphthalene-3:6:3':6'-tetrasulphonic acid, tetrasodium salt) is recommended for the determination of Ca+Mg in limestones and dolomites, etc. The colour change at the end-point at pH 10 is clear, and Ti, Fe, and Al do not form coloured complexes with this reagent at this pH; the Ca+Mg can be titrated directly with EDTA in the presence of these metals with K Na tartrate as a masking agent. [M.A. 13-259, 434]

R. A. H.

**Sen (Sujata).** *Estimation of molybdenum and rhenium in Indian columbite.* Sci. & Cult., 1957, **23**, 318-319.

Mo is precipitated as sulphide, converted into the molybdate, treated with  $\text{SnCl}_2$  and  $\text{SCN}^-$  and the complex extracted with ether, and determined spectrophotometrically. For determination of Re the ore is fused with  $\text{Na}_2\text{O}_2$ , and the  $\text{ReO}_4^-$  separated from molybdate by tetraphenylarsonium chloride and extracted with chloroform. Re is then determined spectrophotometrically. [M.A. 13-142]

R. A. H.

## BOOK NOTICES

**Pegau (Arthur A.).** *Virginia manganese minerals and ores, a selected bibliography with excerpts.* Virginia Div. Geol. Min. Resres. Circ., 1958, no. 7, 1-24.

R. S. M.

**Smith (G. F. Herbert).** *Gemstones.* Revised by F. C. Phillips. London (Methuen), 1958, 560 pp., 133 figs., 27 pls. Price 50s.

**Anderson (B. W.).** *Gem Testing.* Sixth Edition, London (Heywood), 1958, 324 pp., 93 figs. Price 42s.

**Fyfe (W. S.), Turner (F. J.), & Verhoogen (J.).** *Metamorphic reactions and metamorphic facies.* Geol. Soc. America, Mem. 73, 1958, 259 pp., 108 figs. Price \$4.50.

**James (R. W.).** *X-ray Crystallography.* Fifth edition. London (Methuen), 1958. Price 7s. 6d.



**neiderhöhn (H.).** *Die Erzlagerstätten der Erde. Band I. Die Erzlagerstätten der Frühkristallisation.* Stuttgart (Fischer), 1958, 315 pp., 143 figs., 98 tables. Price D.M.34.

**ge (J. D.).** *Selected bibliographies of hydrothermal and magmatic mineral deposits.* Geol. Soc. America, Mem. 75, 1958, 200 pp. Price \$3.75.

**tle (O. F.) & Bowen (N. L.).** *Origin of granite in the light of experimental studies in the system  $\text{NaAlSi}_3\text{O}_8$ - $\text{KAlSi}_3\text{O}_8$ - $\text{SiO}_2$ - $\text{H}_2\text{O}$ .* Geol. Soc. America, Mem. 74, 1958, xi+153 pp., 67 figs., 6 pls. Price \$3.75.

**al (William).** *Structural conversions in crystalline systems and their importance for geological problems.* Geol. Soc. America, Special Paper 66, 1958, ix+183 pp., 93 figs. Price \$3.00.

**stas (A.), Vaes (J. F.), & Guillemin (C.).** *Minéraux d'uranium du haut Katanga.* Tervuren, Belgium ('Les Amis du Musée Royale du Congo Belge'), 1958, 83 pp., 27 pls. (coloured). Price 240 Belg. frs.

**zhinskii (D. S.).** *Physicochemical basis of the analysis of the paragenesis of minerals.* Translation amplified by the author. New York (Consultants Bureau), 1959, 180 pp. Price \$7.50. [M.A. 13-626]

**ri (Conrad).** *Petrochemische Berechnungen auf äquivalenter Grundlage (Methoden von P. Niggli).* Basle (Birkhäuser Verlag), 1958, 280 pp., 65 figs. Price 38 Swiss frs.

**llard (H. H.), Merritt (L. L.), & Dean (J. A.).** *Instrumental methods of analysis.* Third edition, London (van Nostrand), 1958, 626 pp., 350 illus. Price 56s. 6d.

**thian (G. F.).** *Absorption spectrophotometry.* Second edition, London (Hilger & Watts), 1958, viii+246 pp., 68 figs., 18 pls. Price 52s.

**vianes (M.).**—Editor. *Belles roches, beaux cristaux* Paris (Larousse), 1956, 96 pp., 92 photos (32 coloured). Price Fr. 1700. R.A.H.

**ulton (W. H.).**—Editor. *Mechanical properties of non-metallic brittle materials.* London (Butterworths), 1958, 504 pp., 261 figs. Price 90s.

Contains papers dealing with the strength, dynamic mechanical properties and rheological behaviour of coal, porosity and strength of gypsum, stress-strain relations

and breakage of rocks, rock properties in conditions of triaxial stress, and the breakages of ridges of rock.

R. A. H.

**Jakob (Ruth).** *Zur Petrographie von Vulcano, Vulcanello und Stromboli (Aeolische Inseln, Italien).* Zurich (Guggenbühl & Huber), 1958, 117 pp., 40 figs., 4 pls. incl. 3 maps (1 folding). Price 7 Swiss frs.

This classic region is re-examined petrographically. After a short summary of the geology, the minerals of the lavas and intrusions are described, special attention being given to leucite and the relations between its refr. ind. and composition. New analyses of the rocks, 26 by R. Jakob, 8 by J. Jakob, with calculated Niggli values, accompany the petrographical descriptions, and with 22 analyses quoted from earlier works form the basis of an exhaustive chemical study of the rock associations at each centre and of petrogenetic relations between the centres. The Aeolian Islands province, of weakly Mediterranean character, is compared with other Italian provinces; its basic members lie close to the limit of the leucite field, and the formation or inhibition of leucite is controlled by slight change in silica and alkali.

J. Ph.

**[Zavaritzky (A. N.)]** Заварицкий (А. Н.). Изверженные горные породы. [Igneous rocks.] Изд. Акад. Наук СССР. Moscow [Publ. Acad. Sci. U.S.S.R.], 1956, 479 pp., 215 figs. Price 31 r.

This is an excellent and well balanced textbook of petrology devoted entirely to igneous rocks. It is illustrated by numerous drawings of microsections and by other figures. The first part (pp. 15-147) deals with general problems of petrology, mineralogical and chemical composition of rocks, structures, textures, modes of occurrence, age, and relative abundance of various rock-types. The second part (pp. 151-445) provides a detailed description of the principal types of igneous rocks, with examples drawn from classical localities, including a number of Russian ones. In each case, mode of occurrence, texture, mineralogical and chemical composition are discussed. Rocks are grouped as: feldspar-free ultrabasics, gabbro—basalt—diorite—andesite, granite—rhyolite and granodiorite—dacite, syenite—trachyte, nepheline syenite—phonolite, alkali gabbro—basaltoids. Brief notes are allotted to lamprophyres and non-silicate igneous rocks. The bibliography (pp. 446-462), which includes Russian and non-Russian titles, is followed by indexes (pp. 463-475) and a table of contents. S. I. T.



[Ginzburg (I. I.) Гинзбург (И. И.). Опыт разработки теоретических основ геохимических методов поисков руд цветных и редких металлов. [*An essay on the theoretical foundations of geochemical methods of search for ores of non-ferrous and rare metals.*] Гос. Научно-Техн. Изд. Лит. Геол. Moscow [State Sci.-Techn. Publ. Geol. Lit.], 1957, 299 pp., 71 figs. Price 11 r. 70 k.

This book gives a rather full, but in parts sketchy, summary of methods of geochemical prospecting, and of certain geochemical facts and principles on which they are based. Recent developments within the U.S.S.R. are fully reported and critically discussed. The variety of subjects discussed is very great; a selection includes analytical methods in geochemistry, geochemical indicators, concentration and dispersion of elements, aureoles of dispersion, migration and diffusion of elements, various types of geochemical prospecting, prospecting surface deposits, water prospecting, biogeochemical and geobotanical prospecting. The bibliography contains a large number of Russian publications.

S. I. T.

Grange (L. I.) (Compiler). *Geothermal steam for power in New Zealand*. New Zealand Dept. Sci. Indust. Res., 1955, Bull. 117, 1-102 pp., 41 figs., 4 maps. Price 15s.

This bulletin reviews the progress of investigations into the proposed use of geothermal steam as a source of power in the thermal region of the North Island of New Zealand. Chapter 3 (pp. 21-26, 6 figs.), by A. Steiner, describes hydrothermal rock alteration at Wairakei [M.A. 14-18]. The zones of progressive alteration, designated by their characteristic minerals, succeed one another downward in the following order: montmorillonitic clay, mordenite, 'lime zeolite', albite, adularia, and hydromica. A diagram is given showing in outline the probable chemical reactions between the hydrothermal solutions and the rocks. [The 'lime zeolite' noted in this paper has been described as wairakite (M.M. 30-691)].

Chapter 4 (pp. 27-42, 5 figs.), by S. H. Wilson, describes chemical investigations of the hot springs and fumaroles of the district and of the drill discharges at Wairakei. Most of the drill holes in the Wairakei valley, and two near Karapiti, discharge mixtures of steam and water. Chemical evidence suggests that at moderate depths, about 1000 feet below the surface, there is only water, and that all the gas is in solution in the water. At the Karapiti blowhole the gas content of the steam is about 0.05% by volume; its composition is  $\text{CO}_2$  90.94%,  $\text{H}_2\text{S}$  7.86%, with very small

amounts of hydrogen, methane, ethane, nitrogen, ammonia and boric acid. The average content of gas in the steam from bore holes near Wairakei varies considerably from hole to hole, the highest values being 0.5 to 0.6% by volume of the steam. The same constituents as noted in the Karapiti blowhole steam are present in about the same relative proportions; in addition a very small amount of hydrogen fluoride has been recorded.

Analyses of the water separated from steam from the drill holes are also given; in one of these the main constituent is sodium chloride ( $\text{Na}^+$  1130 p.p.m.,  $\text{Cl}^-$  1130 p.p.m.), in the other sodium bicarbonate ( $\text{Na}^+$  230 p.p.m.,  $\text{HCO}_3^-$  670 p.p.m.). A brief description is also given of certain constituents that have been leached from the underground rock formations by the hot water, those studied in detail being sodium, potassium, and lithium. Lithium ( $\text{Li}^+$  reaches up to 21 p.p.m.) is shown to have been leached preferentially (especially when compared with potassium) and the possibility of its recovery on a commercial scale is briefly referred to.

Brief details of the methods of collection of gas and water samples from the fumaroles and drill holes are given.

W. A. W.

Garson (M. S.) & Smith (W. Campbell). *Chilwa Island*. Mem. No. 1, Geol. Surv. Nyasaland, 1958, 127 pp., 14 figs., 8 pls., 2 geol. maps. Zomba (Govt. Press). Price 15s. 6d.

Complete description of Nyasaland's largest carbonate complex, and type example of the Chilwa Series ventose Jurassic age [M.A. 7-36, 12-377]. An aureole of fenitization and potash-feldspathization surrounds concentric rings of sövite and ankeritic sövite. The core is called siderite carbonatite, but oxidation of the Mn-rich chalybite masks its initial composition, and it contains 52%  $\text{CaCO}_3$ . There are minor arcuate dykes of foyaite, juvite, and ijolite, and cone-sheets and radial dykes of nephelinite, phonolite, ijolite-porphyry, trachyte, sölvbergite, and alnöite, and camptonite intrusion. Pyrochlore-rich sövites, with actinolite, apatite, fluorite, etc. are of special interest, as well as melanite sövites developed where foyaite intrudes sövite. Minor accessories in the carbonatites include synchysite, bastnäsite, and a mineral resembling florencite. Eight mineral chemical analyses, with spectrographic data for trace elements, allow comparison between ankeritic and siderite sövites and nearby Basement limestones (graphitic), the carbonatites being distinguished by plentiful Ce and Mn. Partial analyses are given of pyrochlore, and of niobite.



e and sphene. Nb contents of nephelinites and other rocks (145–595 p.p.m.) suggest geochemical links with the sövites. Hydrothermal quartz-fluorite rocks occur, including ferruginous radioactive types with up to 2% ThO<sub>2</sub>, 2% rare earths associated with goethite. Economic possibilities (mainly niobium) are reviewed, and petrogenesis is discussed.

T. D.

**Forés (J. L.).** *Cristalofísica. I—Propiedades continuas.* Madrid (Aguilar S.A. de Ediciones), 1958, 238 pp., 83 figs., 88 tables. Price 120 ptas.

In this book, the first volume of a treatise on crystal physics, deals with the whole range of physical properties of crystals. General questions, such as anisotropy and application of tensorial calculus to crystal physics and symmetry, are considered in the first chapter. Chap. II deals with the scalar properties density, specific heat, melting-point, molecular weight, etc.; Chaps. III–VI with piezoelectricity, pyromagnetism, homogeneous deformation, thermal conductivity, and magnetic induction. Chap. VII (4 pp.) considers optical properties with reference to both transmitted and reflected light, and includes optical activity. The last two chapters, VIII and IX, deal with the elasticity

of crystals and piezoelectricity. Special attention is given throughout to the relation between physical properties and crystal structure, and the book is thus of a most modern standard.

M. F.-A.

**Lehmann (H.).** *Zehn Jahre—Institut für Steine und Erden der Bergakademie Clausthal.* Goslar (Schriftenreihe Steine und Erden, Band 1, Hermann Hübener Verlag), 1958, 87 pp., 19 figs.

This booklet gives an account of the development of the work of the Institute over the last ten years under the direction of Prof. Hans Lehmann, and has a brief historical section and an account of the new buildings, which are expected to be ready for occupation this year. After details of lecture courses, student activities, colloquia, titles of theses presented, and papers published from the Institute over the last ten years, some 40 pp. are devoted to brief descriptions of unpublished work, largely concerned with clays. Finally notes are given of apparatus in use at the Institute. The Institute is well known for its contribution to clay research; and from the unpublished work in progress it would seem that much more may be expected within the next few years.

R. C. M.

## CLAY MINERALS

### Treatment and Methods

**egg (S. J.), Hill (K. J.), & Parker (T. W.).** *The grinding of kaolinite. I. A preliminary study.* Journ. Appl. Chem., 1954, 4, 631–632.

**egg (S. J.), Parker (T. W.), & Stephens (Marjorie J.).** *The grinding of kaolinite. II. A more detailed study.* Ibid., 666–674.

Two samples of refined Devon china clay have been ground for 94 and 120 hours. The specific surface, heat of immersion in CCl<sub>4</sub>, and base-exchange capacity all increased appreciably but the content of structural water was scarcely affected: the density in CCl<sub>4</sub> fell. Another sample of kaolinite was ground for 1000 hours and thermogravimetric and X-ray examination showed that the structure was progressively distorted but that its chemical composition was unchanged.

R. A. H.

**Illère (S.), Hénin (S.), & Esquevin (J.).** *Transformation expérimentale de chlorite en montmorillonite.* Clay Min. Bull., 1954, 2, 166–170, 3 figs.

Synthetic and natural swelling chlorites (or pseudochlorites) give montmorillonite on treatment with HCl; a closely-related non-swelling mineral from Angeviller yields nontronite on treatment with Na<sub>2</sub>S<sub>2</sub>O<sub>4</sub> and sodium tartrate. The easy transformation from pseudochlorite to smectite is probably due to the incomplete nature of the interlayer hydroxide sheet.

R. C. M.

**Ray (S.), Gault (H. R.), & Dodd (C. G.).** *The separation of clay minerals from carbonate rocks.* Amer. Min., 1957, 42, 681–686.

Various acidic reagents have been used to effect the solution of the carbonate fraction of quartz-carbonate-hectorite mixtures, and X-ray powder photographs of the residue show whether the hectorite was destroyed during the chemical attack. The use of hydrochloric and formic acids must be restricted to solutions of pH not less than 2 at room temperature. The cation-exchange resin, Amberlite IRC-50, can be used at higher temperatures with reaction times comparable to the above acids for limestones and less for dolomites. 4.4 M acetic acid (1:3 by volume) is as

effective as the resin for limestones, but less so for dolomites. Amberlite IR-120, in its  $\text{NH}_4^+$  form is less desirable than IRC-50 in the  $\text{H}^+$  form because of slower reaction.

G. D. N.

**Maguire (S. G. Jr.) & Phelps (G. W.).** *Practical particle-size analysis of clays: II, a simplified procedure.* Journ. Amer. Ceram. Soc., 1957, **40**, 403-409, 3 pls., 10 figs.

Particle size analyses of whiteware clays are made with a hydrometer. By skeleton plotting of hydrometer data on log probability paper, recognition of particle size distributions well into the colloidal region is possible. P. K. H.

**Porrenga (D. H.).** *The application of a multiple Guinier camera (after P. M. de Wolf) in clay mineral studies.* Amer. Min., 1958, **43**, 770-774, 4 figs.

Because of preferred orientation of crystals weak basal X-ray reflections have been obtained hitherto using the Guinier camera. A sample-mounting technique, which gives a rippled surface to the clay specimen and thus increases the intensity of basal reflections, is described. The advantages of the Guinier camera are listed.

B. H. B.

**Martin (R. T.).** *Clay-carbonate-soluble salt interaction during differential thermal analysis.* Amer. Min., 1958, **43**, 649-655, 1 fig., 3 tables.

In most fine-grained soils qualitative or quantitative d.t.a. determinations of calcite and dolomite may be made. In some cases the carbonate, as much as 40%, may escape d.t.a. detection, because of a combination of certain factors. Thus, soluble salts, e.g. NaCl or KCl, may react with silicates (clay minerals in particular) during a d.t.a. analysis; the products of reaction may combine with carbonate minerals and produce anomalous thermal effects. Soluble salts tend to lower the carbonate decomposition temperature. Some hydrous micas seriously distort characteristic calcite thermograms even with no soluble salts present. B. H. B.

**Caillère (S.), Oberlin (A.), & Hénin (S.).** *Étude au microscope électronique de quelques silicates phylliteux obtenus par synthèse à basse température.* Clay Min. Bull., 1954, **2**, 146-156, 8 figs.

Mixing of very dilute solutions (10-20 mg/l) of appropriate salts, either at room temperature or at the boiling point, gives synthetic clay minerals, the type depending largely upon the pH of the solutions. The aspect under the

electron microscope of various products is described. It is concluded that the octahedral sheet forms first and that tetrahedral sheets attach themselves to it. R. C. M.

**Honjo (G.), Kitamura (N.), & Mihama (K.).** *A study of kaolin minerals by means of single-crystal electron diffraction diagrams—the structure of tubular kaolin.* Clay Min. Bull., 1954, **2**, 133-141, 7 figs.

Electron diffraction patterns of single tubular crystalline kaolin minerals from Hong-Kong and from Bedford, Indiana, U.S.A., are interpreted as indicating a two-layer triclinic structure with  $\alpha$  91.8°,  $\beta$  83°. The symmetry is higher than that expected for halloysite. The degree of crystallinity is best in the Hong-Kong sample and poorest in the Bedford sample; other minerals of the same type examined are intermediate. Some interlayer water may occur. R. C. M.

**Correns (G. W.).** *Ueber die mikroskopische Untersuchung von Mineralen in Tonen.* Clay Min. Bull., 1954, **2**, 128-131, 4 figs.

No single method of investigation is satisfactory for a clay; the evidence given by all available methods must be correlated in order to assess the true nature of the material. The methods in use at Göttingen (X-ray diffraction, differential thermal analysis, electronoptical examination and optical methods) are briefly discussed and particular attention is drawn to the use of phase-contrast microscopy in clay mineralogy. R. C. M.

**Hegemann (F.) & Hert (W.).** *Die quantitative flamm-spektrometrische Bestimmung von K, Na, Ca und Al in Kaolin.* Ber. dtsh. keram. Ges., 1958, **35**, 258-260.

The sample is decomposed with HF-oxalic acid. Interference of Al in the  $\text{Na}_2\text{O}$  and  $\text{K}_2\text{O}$  determination is avoided by adding a mean amount of Al to the standard solutions for these elements: this also suppresses the effects of Fe and Mg.  $\text{Al}_2\text{O}_3$  may be determined after the addition of *n*-butanol, the appropriate amounts of Na and K being added to the standard solutions to compensate for the interfering effects of these elements. The CaO determination is direct, only the acidity being controlled. For kaolins good agreement with conventional chemical analysis is obtained. R. C. M.

**Schmidt (W.) & Konopicky (K.).** *Flammenspektrometrische Bestimmung des Aluminiums in Tonerdasilikaten.* Ber. dtsh. keram. Ges., 1958, **35**, 317-321.



Fe, Ti, Na, Ca, Mg, K,  $H_2SO_4$ , HCl, and  $NH_4Cl$  interfere with the direct determination of Al in the presence of ethanol in the flame spectrometer. A method for Al involving precipitation with  $NH_4OH$  from the  $HF-H_2SO_4$  extract of the silicate, followed by solution in HCl and use of standards containing appropriate amounts of Fe and Ti is recommended [cf. preceding abstract]. R. C. M.

Boersma (S. L.). *A theory of differential thermal analysis and new methods of measurement and interpretation.* Journ. Amer. Ceram. Soc., 1955, **38**, 281-284.

The theory of differential thermal analysis is discussed and a new type of specimen holder reputed to overcome certain shortcomings is described. An apparatus is proposed whereby differential thermal curves may be synthesized.

R. C. M.

Wietze (H. E.) & Ziegler (G.). *Grundlagen und Anwendungsbereiche der dynamischen Differenzkalorimetrie.* Ber. dtsh. keram. Ges., 1958, **35**, 193-204.

A modification of differential thermal analysis ('dynamic reference calorimetry') is described whereby, it is claimed, the rates of reaction may be accurately determined. The apparatus is essentially similar to that of Boersma [preceding abstract]. The method is checked by its applicability to several reactions.

R. C. M.

Rich (D. G.) & Buchanan (J. R.). *Anomalies in techniques for preparing H-bentonites.* Proc. Soil Sci. Soc. America, 1958, **22**, 281-285.

Various procedures for the preparation of H-bentonites to be used in physical-chemical studies of clay systems have been examined. Their effects upon the exchangeable H and content of these bentonites have been evaluated by titration curves and chemical analyses. A procedure proposed for reducing the amount of exchangeable Al in such preparations involves pretreatment of the bentonite suspension with HCl and NaCl solutions followed by removal of excess electrolyte and passage of the suspension through an H-resin column. The exchangeable H and Al status of bentonites thus prepared is discussed.

C. D. J.

### Properties and Structure

Andrade (V.) & Rodriguez (M. C.). *Modificación de las propiedades adsorbentes de los minerales arcillosos mediante tratamiento térmico y catión de cambio—I.* An. Edaf. Fisiol. Veg., 1957, **16**, 799-856, 45 figs.

The authors studied different groups of homoionic laminar silicates to see the influence of the following factors on the adsorption of acetic and butyric acids: nature of material, adsorbed compounds, exchange cation, and thermal treatment. The adsorption in moles per gramme of sample have been calculated by the formula  $x = v\Delta c/m$ ; where  $m$  is the weight of the sample,  $v$  the volume of the solution and  $\Delta c$  the change observed in the concentration of the solution. The adsorption varies in the order kaolin—illite—halloysite—montmorillonite; it is higher for acetic than butyric acid, twice as high in some samples; the nature of the exchange cation has a clear influence on the adsorption, depending on the class of mineral; the adsorption capacity decreases after thermal treatment when the mineral loses reticular water.

M. F.-A.

Ames (L. L.) & Sand (L. B.). *Factors affecting maximum hydrothermal stability in montmorillonites.* Amer. Min., 1958, **43**, 641-648, 3 tables.

Three important factors affect the maximum thermal stability of montmorillonites in hydrothermal systems: interlayer cations, gross composition, types of lattice substitutions (tetrahedral or octahedral). The absence of an interlayer alkali cation (Na) causes lower temperature of decomposition—300°C for Mg-montmorillonites, 400°C for Al-montmorillonites. With optimum substitution and alkali cation present maximum hydrothermal stabilities for Mg- and Al-montmorillonites are 750°C and 480°C respectively, and are independent of substitution in the octahedral or the tetrahedral layer. A gross decrease in stability follows deviation from optimum substitution, e.g., in Mg-montmorillonites the decomposition temperature drops from 750°C with  $Al_{0.33}$  to 255°C with no Al.

B. H. B.

Faust (G. T.). *A study of the montmorillonite variety, galapektite.* Journ. Washington Acad. Sci., 1957, **47**, 143-146.

Galapektite from Angleur, Belgium, previously identified with both halloysite and montmorillonite, is shown to be a typical dioctahedral montmorillonite. D.t.a. patterns and X-ray powder data are identical with those of a Lemon, Missouri, montmorillonite. It is proposed to discontinue the use of the name galapektite in favour of montmorillonite.

F. A. M.

Faust (G. T.). *The relation between lattice parameters and composition of montmorillonite-group minerals.* Journ. Washington Acad. Sci., 1957, **47**, 146-147.

By means of the formulae discussed by Brindley (Clays and Clay Technology, Proc. First Nat. Conf. on Clays and Clay Techn., Calif. Div. Mines Dept., Bull. 169, 1955, 33-43) for calculating the lattice parameter  $b$  from the composition of di- and trioctahedral montmorillonites, values have been determined for specimens of griffithite, galapektite [see previous abstract], stevensite, and iron saponite. Excellent agreement with the observed values was found. F. A. M.

**Brindley (G. W.) & Rustom (Mahmoud).** *Adsorption and retention of an organic material by montmorillonite in the presence of water.* Amer. Min., 1958, **43**, 627-640, 7 figs., 3 tables.

This is an investigation of the system montmorillonite-organic material-water, the clay being a purified Wyoming bentonite, the organic material a polyethylene glycol ester of oleic acid known as 'Nonisol 250'. At low organic content a partition of 70% of organic material occurs in the clay, only 30% in the solution. The lattice spacing  $d(001)$  of wet clay-organic samples was 18.5-19Å largely irrespective of the exchangeable cations, Na, Ca, Mg, and the amount of adsorbed organic material. With samples dried at 110°C ordered complexes are found containing one layer or two layers of organic material between silicate layers; in appropriate composition ranges mixtures of one-layer and two-layer types are observed, rather than mixed sequences. Two-layer clay-organic complexes have  $d(001)$  of 17.2Å for Na and Ca clays and a one-layer  $d(001)$  of 13.7-13.9Å; for Mg clays the spacings are 17.8Å and 13.7-14.2Å respectively. Repeated water washings, 15 or more, reduce two-layer to one-layer types, but the one-layer sequence is firmly held. B. H. B.

**Glaeser (R.) & Méring (J.).** *Isothermes d'hydratation des montmorillonites bi-ioniques (Na, Ca).* Clay Min. Bull., 1954, **2**, 188-193.

For Camp-Bertaux montmorillonite saturated with Ca and Na in the proportions  $f\text{Ca}/2, (1-f)\text{Na}$  'demixing' of phases occurs when  $f$  exceeds 0.3; this is in agreement with symmetry  $C-2$ . Demixing is incomplete at relative humidity values less than 75%. R. C. M.

**Goldsztaub (S.), Hénin (S.), & Wey (R.).** *Sur l'adsorption d'ions phosphoriques par les argiles.* Clay Min. Bull., 1954, **2**, 162-166, 4 figs.

Sorption of phosphate by Na- and Ca-montmorillonite and kaolinite is a maximum at pH 4-5, and is believed to

be due to edge Al ions. The calculated sorption on such basis for montmorillonite (21me.  $\text{H}_2\text{PO}_4/100\text{g}$  clay) agrees well with the experimental value ( $18 \pm 2\text{me. H}_2\text{PO}_4/100\text{g}$  clay); in addition, pyrophyllite sorbs phosphate, but hectorite do not. R. C. M.

**Sawhney (B. L.) & Jackson (M. L.).** *Soil montmorillonite formulas.* Proc. Soil Sci. Soc. America, 1958, **22**, 115-118.

From cation-exchange capacity, specific surface, thermal and chemical analysis data, formulas were derived for typical soil montmorillonites selected on the basis of X-ray diffraction analysis after removal of free iron oxides and amorphous constituents. The formula of montmorillonite from the fine clay from Houston soil,  $(\text{Si}_{7.46}\text{Al}_{0.54})(\text{Al}_{2.68}\text{Fe}^{III}_{0.32}\text{Mg}_{0.56})\text{O}_{20}(\text{OH})_4\text{X}_{0.92}$  fell on the beidellite end of the montmorillonite-beidellite-nontronite series, with more than 115% of the exchange charge, X, corresponding to 115me. per 100g of colloid, originating in the tetrahedral sheet. Representing the montmorillonite end of the series, the Miami loam and Black Cotton soil, the clays had octahedral origin of over half the total negative charge. Nontronitic composition was represented by several fine clays derived from basaltic rocks. C. D. J.

**Low (Philip F.) & Duwayne (M. Anderson).** *The partial specific volume of water in bentonite suspensions.* Proc. Soil Sci. Soc. America, 1958, **22**, 22-24.

An equation was derived relating the partial specific volume of water in a clay suspension to the clay concentration and the suspension density. By means of this equation and the observed suspension densities at different clay concentrations, the partial specific volume of water was determined to be the same as that of pure water in Li-, Na-, and K-clay suspensions at concentrations up to 0.14g of clay per 100g (13% clay). From these results it was possible to calculate the densities of Li-, Na-, and K-clay, which respectively were 2.71, 2.80, and 2.75. C. D. J.

**Runkles (J. R.), Scott (A. D.), & Nakayama (F. S.).** *Oxygen sorption by moist soils and vermiculite.* Proc. Soil Sci. Soc. America, 1958, **22**, 15-18.

A standard method of measuring gas adsorption was used to measure the oxygen sorbed by soils and vermiculite which contained varying amounts of water. The amount of oxygen sorbed by the air-dry soils was 5 to 8 times that which could be accounted for by solubility in the water alone. Thus, some adsorption of oxygen occurred in the



ce of 2 to 6% water. When the soils were oven-dried at 5°C for 48 hours, much more oxygen was sorbed. Illite, on the other hand, sorbed a constant amount of oxygen when the moisture content, based on oven-dry weight, at 105°C for 48 hours, was decreased from 50 to 0%. On further heating, the vermiculite sorbed less oxygen. At moisture contents (50 to 300%), the oxygen sorbed by the vermiculite-water system was essentially equivalent to the theoretical solubility of oxygen in free water. The oxygen sorbed by the Edina subsoil-water system at moisture contents between 10 and 25%, on the other hand, was less than the solubility of oxygen in free water.

C. D. J.

**Umbrum (L. E.) & Hoover (C. Dale).** *Potassium release and fixation related to illite and vermiculite as single minerals and in mixtures.* Proc. Soil Sci. Soc. America, 1958, **22**, 222-225.

Retention and release of K were studied under moist and equilibrium conditions. Clay and silt fractions of illite and vermiculite, as single minerals and in mixtures, were used in the experiments. Nonaqueous solutions were compared with aqueous solutions as K extractants to evaluate the effect of rehydration upon K release. The drying of illite decreased the amounts of K removed by aqueous solutions; vermiculite decreased the amounts removed by nonaqueous solutions. Illite fixed no applied K against aqueous extraction, but vermiculite fixed large amounts. Silt fractions of illite were nearly as efficient in K release as were clay fractions. Mixtures of illite and vermiculite showed decreased exchangeable K upon drying, reversion of this K upon remoistening, and fixation of applied K. These effects were not all present when the minerals were tested singly. 'Attenuation effects' were induced in vermiculite-free soil clays by the addition of vermiculite to the sample.

C. D. J.

**Ugaglia (U.).** *Sur les variations chimiques et structurales des différents minéraux des argiles.* Clay Min. Bull., 1954, **2**, 179-183.

Minerals in clays belong to only a few closely interrelated groups. Thus, phlogopite is considered to be a mica with Al-for-Si substitution, anauxite to have holes in the octahedral sheets rather than extra silica layers, chlorites to form continuous series with micas, talc, and pyrophyllite, and vermiculite to be related to a chlorite-series as montmorillonite is to a mica-talc series.

R. C. M.

**Ventriglia (U.).** *La plasticité des argiles.* Clay Min. Bull., 1954, **2**, 176-179.

A discussion upon the concept of plasticity. Plasticity can only be envisaged for systems where (a) the substance is continuous, (b) the viscosity has a finite value, (c) the substance is beyond the elastic limit. The conditions under which plasticity values for clays of different mineralogical composition can be compared are defined.

R. C. M.

**Pézerat (H.) & Méring (J.).** *Influence des substitutions isomorphes sur les paramètres de structure des phyllites.* Clay Min. Bull., 1954, **2**, 156-161, 3 figs.

One-dimensional Fourier syntheses for pyrophyllite, montmorillonite, and muscovite show that the oxygen ions of the outer layers superpose exactly. Hence the different 001 spacings arise from differences in the interlayer space and are related to the balance of electrostatic repulsive and attractive forces. Isomorphous substitution appears to affect the *a* and the *b* but not the *c* dimension.

R. C. M.

**Kakitani (S.).** *Some properties of the clay from Arima.* Journ. Min. Soc. Japan, 1957, **3**, 130-136 (in Japanese).

Tertiary clay overlying liparite and granite in Yamaguchi village, near Arima, Hyogo Prefecture, is composed mostly of montmorillonite, with some albite and quartz; the water in equilibrium with the clay after 1½ hours had pH 5.2. Various sorts of cation clay were made by adsorbing Na, K, Mg, or Ca. The basal spacings were 12.69 Å, 13.42, 15.80, and 15.88 for the K-, Na-, Mg-, and Ca-clays respectively; the viscosities were in the order Na-clay > Mg-clay > Ca-clay > white natural clay > pink natural clay > K-clay.

R. A. H.

*Note.* Two journals are published by the Mineralogical Society of Japan; the *Mineralogical Journal*, six-monthly, containing papers mostly in English; and the *Kôbutsugaku Zasshi* [Journ. Min. Soc. Japan], four-monthly, containing papers in Japanese.

**Hayashi (H.) & Sudo (T.).** *Zeolite-bearing bentonites.* Min. Journ. [Japan], 1957, **2**, 196-199.

X-ray powder diffraction data are given for zeolite-bearing bentonites from clay at Yokoté, Akita Prefecture, which occurs in tuffaceous sediments, and in clay from Bodai, Ishikawa Prefecture, occurring between tuff and liparite. Chemical analyses are given for various fractions of the bentonitic clays: an analysis by H. Hayashi of a

zeolite of the mordenite group occurring as aggregates of fine silk-like threads in the Bodai clay gave  $\text{SiO}_2$  66.96,  $\text{TiO}_2$  tr.,  $\text{Al}_2\text{O}_3$  12.66,  $\text{Fe}_2\text{O}_3$  0.82,  $\text{MgO}$  0.80,  $\text{CaO}$  5.96,  $\text{Na}_2\text{O}$  2.94,  $\text{K}_2\text{O}$  0.40, ign. loss 6.28,  $\text{H}_2\text{O}$  2.96, = 99.78. [M.A. 5-357] R. A. H.

**Nakahira (M.).** *The polymorphism of sericite.* Clay Min. Bull., 1954, **2**, 141-146, 2 figs.

A greenish mica from Unnan Mine, Shimane Prefecture, Japan, identified from chemical analysis [not quoted] as a magnesium sericite, has a three-layer structure with an orthohexagonal cell with  $a$  5.23Å,  $b$  9.06Å, and  $c$  30.0Å, possible space groups being  $D^8_3-P3_112$  and  $D^5_3-P3_212$ . The classification of and relationships between polymorphic and disordered forms are discussed. Most Japanese sericites have some structural defects, but the above sample would appear to be intermediate between the usual type and a true polymorph. [M.A. 12-98] R. C. M.

**Sudo (T.).** *Long spacing at about 30Å confirmed from certain clays from Japan.* Clay Min. Bull., 1954, **2**, 193-203, 2 figs.

Clays from the altered aureole around the central ore-body in the "Kurokô" deposit in Hanaoka Mine, Akita Prefecture, give complex X-ray patterns. The effects of heating and of treatment with ethylene glycol were investigated by X-ray methods, and the clays were also subjected to d.t.a. and to examination by electron microscopy. A 29.6Å spacing in one clay is accounted for by regular interstratification of montmorillonite with a 'G-lattice' (one gibbsite layer between two pyrophyllite layers)—irregular interstratification gives 14.7Å—and a 26.7Å spacing in another by regular interstratification of magnesian chlorite with sepiolite. In the second clay a line was also observed at about 40Å. R. C. M.

**Mitsuda (T.).** *Long spacing clay mineral from the Uku mine, Yamaguchi Prefecture, Japan.* Min. Journ. [Japan], 1957, **2**, 169-179, 5 figs.

A white powdery clay mineral with 28.8Å spacing occurs in a kaolinite vein in siliceous lenticular masses also containing andalusite, in liparite, in the Uku mine. A chemical analysis and X-ray diffraction patterns indicate that the material is mostly kaolinite. The 14.5Å line shifts to 15.4 and the 28.8Å line shifts to 31.0 after treatment with ethylene glycol. The results of heat treatment are also

reported. The large spacing is considered to be due to regularly alternate stacking of a montmorillonite 1:1 (basal spacing about 14.8Å) with a hypothetical alumin chlorite lattice (basal spacing about 14.0Å). [M.A. 12-99] R. A.

**Kakitani (S.).** *Infrared absorption studies on some minerals (on the OH-stretching vibration of montmorillonite, kaolinite and halloysite Supplement).* J. Min. Soc. Japan, 1956, **3**, 49-52 (in Japanese).

The infrared absorption spectra due to the OH radical are listed for these minerals. The montmorillonite absorption at 2.76μ is attributed to the OH radical while at 2.8-3.0μ are attributed to the interlayer  $\text{H}_2\text{O}$  molecule. When montmorillonite is heated for five hours in a Hg vacuum the broad absorptions at 2.8-3.0μ all disappear while the sharp absorption at 2.76μ disappears at about 810°C. Both kaolinite and halloysite show OH radical absorptions at 2.76μ and 2.71μ respectively; these disappear at 700°C. R. A.

**Bradley (W. F.).** *Molecular association between montmorillonite and some polyfunctional organic liquids.* Journ. Amer. Chem. Soc., 1945, **67**, 975-981.

The association of a number of polyfunctional saturated aliphatic chains with montmorillonite gives evidence of augmented attraction of the nature of a C-H...O interaction between methylene groups and the oxygen surfaces of the clay. W. A. W.

**Barrer (R. M.) & Reay (J. S. S.).** *Sorption by  $\text{NH}_4^+$  and  $\text{Cs}^+$ -montmorillonites, and ion fixation.* Journ. Chem. Soc., 1958, 3824-3830, 4 figs.

The sorptive capacities of these ion-exchanged derivatives of montmorillonite for  $\text{N}_2$ ,  $\text{O}_2$ , A,  $\text{CH}_4$ ,  $\text{C}_6\text{H}_6$ , and  $\text{H}_2\text{O}$  are related to the intersheet spacings of these minerals. The spacings are intermediate between that of the natural montmorillonite and those of the alkylammonium derivatives. [M.A. 13-152, 518] R. A.

**Murray (P.) & White (J.).** *Kinetics of the thermal decomposition of clays.* Trans. Brit. Ceram. Soc., 1949, **46**, 187-206.

After general consideration of the kinetics of decomposition reactions, heating experiments on certain common clays which contain predominantly kandites and smectites



scribed. These show that in all instances the dehydroxylation reaction is of the first-order type; the activation heats of activation were derived: Supreme 37970 cal/mol, Newton Abbot ball clay 34310 cal/mol, Wyoming bentonite 57640 cal/mol, Eureka halloysite 3740 cal/mol. From the data obtained differential thermal curves for various heating rates may be synthesized. Other implications of the results are considered.

R. C. M.

### Petrological

**Gunnar (Gunnar).** *Hydrothermale Tonminerale in SW-Schweden.* Acta Acad. Aboensis, Math. & Phys., 1958, **21**, no. 12, 1-13.

Mineral inclusions in the crystalline limestone (Precambrian) of the region contain, in addition to the usual cavity minerals, a clay-like material the <0.05 mm fraction of which has been identified by X-rays and chemically, and in some cases microscopically. The clay material from a cavity measuring 1 by 1 metres (Lammela, Västana fjärd) contained 55.26% of a mineral identified as chamosite with composition  $\text{Fe}^{III}_{1.25}\text{Fe}^{II}_{1.53}\text{Mg}_{0.61}\text{Ti}_{0.02}(\text{Si}_{1.35}\text{Al}_{0.65})\text{O}_5(\text{OH})_4$ . In the unmineralized cavities 0.5 m in diameter (Niksor, Finby) the reaction contained 97.75% of a mineral which from the X-ray diagram is either glauconite or celadonite of composition  $(\text{K}_{0.42}\text{Ca}_{0.07}\text{Na}_{0.71})(\text{Al}_{0.69}\text{Fe}^{III}_{0.45}\text{Fe}^{II}_{0.36}\text{Mg}_{0.44}\text{Ti}_{0.08})_2\text{Al}_{0.83}\text{O}_{10}(\text{OH})_2$ . In the cave-like depressions in the quarry of Pargas a clay mineral making up 76.64% of the fraction was identified by X-rays as nacrite; the composition of the fraction is given as  $\text{SiO}_2$  37.31,  $\text{Al}_2\text{O}_3$  30.26,  $\text{FeO}$  11.52,  $\text{FeO}$  5.14,  $\text{MgO}$  0.65,  $\text{TiO}_2$  3.73,  $\text{CaO}$  0.00,  $\text{H}_2\text{O}$  12.13, = 100.74; analysis of the nacrite is not given. The high  $\text{TiO}_2$  is accounted for by the presence of ilmenite. In the cavity in the quarry of Rosendal, Kimito, the kaolin was identified as dickite, the powder pattern but no chemical analysis being given. All the clay minerals of the cavities are considered to be of hydrothermal origin. V. M.

**Fontboté (J. L.), Fontboté (J. M.), Rausell-Colom (J. A.), & Truyols (J.).** *Sobre la composición mineralógica de las arcillas del Mioceno del Vallés-Penedés.* Estudios Geológicos, 1957, **13**, (nos. 35, 36), 305-321, 3 figs.

A set of samples of clay rocks has been investigated by X-ray diffractometric analysis, X-ray diffraction, and d.t.a. Their mineralogical composition is complex with the illite slightly predominating. The samples were collected in well-studied localities, where valuable data are available for the

interpretation of the conditions of the sedimentary environment. The paleogeographical conclusions deduced from the mineralogical composition agree with the ones reached by Crusafont from paleobiological research. M. F.-A.

**Gutiérrez Rios (E.), Martín Vivaldi (J. L.), & Pino Vazquez (C. del).** *Génesis de la montmorillonita de Marruecos Español—II.* An. Edaf. Fisiol. Veg., 1957, **16**, 787-798, 4 figs.

As a contribution to the study of the genesis of montmorillonite in nature, the authors performed several determinations on a group of materials from Tidinit deposits (Spanish Morocco). These represent a transition from the parent rock to the montmorillonite. X-ray diffraction, d.t.a. curves, and electron microscope photographs show an increasing amount of montmorillonite in the series of selected samples, the parent rock being a leucocratic variety of dacite. M. F.-A.

**Paneque (G.) & González García (F.).** *Composición mineralógica y génesis de algunos tipos de suelos calizos béticos. I—Mineralogía de las fracciones gruesas.* An. Edaf. Fisiol. Veg., 1957, **16**, 907-957, 18 figs.

The authors reported the mineralogical results obtained with the sand fractions of different types of soils from Ecija (Seville). Xenorendzines are the less developed soils, they have highest proportion of calcium carbonate in their profile, and the smallest ratio of heavy to light minerals. Andalusian black earth has the highest degree of chemical erosion, the least amount of  $\text{CaCO}_3$ , and a higher proportion of heavy minerals in relation to light minerals. The red calcareous loams and the brown gleized ones corresponding to relict formations occupy an intermediate position in the degree of chemical erosion; the former close to the black earths and the latter to the xenorendzines. The proportion of feldspars plus mica decreases in the series xenorendzines - brown loam - red loam - black earth, which agrees with the degree of chemical erosion in these soils. M. F.-A.

**Scheere (J.).** *Contribution à l'étude des Tonstein du Terrain houiller belge.* Publ. Assoc. Étude Paléont. Stratigr. Houillères, Brussels, 1955, no. 19, 38 pp., 3 pls.

Description of "tonstein" from seven Coal Measures beds. Five complete and eight partial analyses are given. Kaolin often occurs in vermicular crystals and is the only clay-mineral present. The "tonstein" is considered to result from the transformation of detrital shales in acid environment. R. V. T.

**Scheere (J.).** *Nouvelle contribution à l'étude des Tonstein du Terrain houiller belge.* Publ. Assoc. Étude Paléont. Stratigr. Houillères, Brussels, 1956, no. 26, 54 pp., 6 figs, 5 pls.

Macroscopic and microscopic description (6 pp., 4 pls.) of four "tonstein" beds from the Campine and the Borinage coal fields. X-rays show the presence of kaolinite, chalybite, and quartz.

R. V. T.

**Byström (Ann-Marie).** *The clay minerals in the Ordovician bentonite beds in Billingen, Southwest Sweden.* Geol. Fören. Förh. Stockholm, 1957, **79**, 52-56, 1 fig.

The clay minerals of the bentonite of Billingen are shown, by means of X-ray examination, to consist of "mixed layer" types with an illitic predominance. Treatment with glycerol shows swelling of complex nature, with a strong reflection at 11.8Å and a less strong at 9.7Å. The K<sub>2</sub>O content is 7.75% on the <2 $\mu$  fraction (110°C dry basis). The original bentonites are shown to have partly changed into muscovite and chlorite. A close resemblance with the K-bentonites of Pennsylvania is pointed out. P. Lggn.

**Byström (Ann-Marie).** *Mineralogy of the Ordovician bentonite beds at Kinnekulle, Sweden.* Sveriges Geol. Unders., 1956, Ser. C, **540**, 1-62, 13 figs, 4 pls.

The clay minerals of the Ordovician bentonite (*Chasmops* layer) of Kinnekulle are examined by means of dispersion and fractionation, chemical analysis, studies on cation exchange capacities, X-ray methods, d.t.a. acid extractions, and electron micrographs. The clay minerals are dominated by two types of 'mixed layer' minerals of illite and montmorillonite in random interstratification. Type I, which dominates the main bed (2m thick) has K<sub>2</sub>O about 2.7%, base exchange capacity 65-70 me/100g, and inner basal reflexions of glycerol-treated specimens at 18Å and 9.3Å. Type II, which is found in upper thin beds (15 cm each), has K<sub>2</sub>O about 5%, base exchange capacity 46 me/100g, and inner basal reflexions at 14Å and 9.6Å. The structural formulae are given. The non-clay mineral content of the thick bed was found to include biotite, quartz, plagioclase, and sanidine, indicating a volcanic origin of the bentonite beds.

P. Lggn.

**Bakr (M. Y.).** *Die keramische Industrie Ägyptens. Übersicht über einige plastische Rohstoffe.* Ber. dtsh. keram. Ges., 1959, **36**, 39-41.

Five samples from Sinai and Aswan were investigated by chemical and physical methods. All are predominantly kaolinite, which in the Sinai kaolin is highly crystalline but in the Aswan clays is disordered. Under the electron microscope the kaolinite in the Aswan clays appears better crystallized than that in the Sinai kaolin [cf. M.A. **12**]. The Sinai kaolin has the smallest amount of impurity (largely anatase); the other clays contain large amounts of quartz, in some instances free Fe<sub>2</sub>O<sub>3</sub>, and possibly small amounts of other clay minerals.

R. C.

**[Parfenova (E. I.) & Yarilova (E. A.)]** Парфенова (Е. И.) и Ярилова (Е. А.). Задачи и методы почвенно-минералогических исследований под микроскопом. [Problems and methods of soil-mineralogical investigations under the microscope]. Почвоведение [Pedology], 1958, **12**, 28-35, 8 figs. in 2 pls.

A description of the type of information which may be derived by the application of thin-section and immunochemical methods to soils. The group names biolite [биолит], polynite [M.A. **13**-580] are used to designate minerals formed by biological action (e.g. phytolites, calcium oxalate, etc.) and authigenic minerals of the montmorillonite group, respectively.

R. C.

**Holte Dahl (H.).** *A petrographical and mineralogical study of two high altitude soils from Trollheimen, Norway.* Norsk Geol. Tidsskr., 1952, **32**, 2-4, 191-226, 10 figs.

Soils of two sections from the summit-plateau of Mt. Gjevilvasskamm, 1640m above sea level, have been studied. Soil I is assumed to be a weathering product of the underlying hornblende schist. The weathering is mainly physicochemical. Soil II is believed to be of glacial origin, but highly modified by weathering in its upper part. Here also the weathering is believed to be mainly physical. The age of the soils is not thought to be older than the last (Wisconsin) glaciation.

Fd. I

**Eder (T.), Magasrevy (J.), Temt (T.), & Wiedenbeck.** *Nirgua-Rohkaolin, ein besonderer Rohstoff Venezuelas.* Ber. dtsh. keram. Ges., 1958, **35**, 285-294.

The kaolinisation of rocks (largely feldspar-bearing schists of Cretaceous, or older, age) in the neighbourhood of the village of Nirgua, 110 km. from Valencia, Venezuela, has given a deposit of several hundred thousand tons of kaolin. Pockets of high-grade kaolin of workable size have been found. Chemical analysis of two samples gave SiO<sub>2</sub> 48.5 and 49.5%.



,  $\text{TiO}_2$  0.3, 0.3,  $\text{Al}_2\text{O}_3$  33.9, 31.7,  $\text{Fe}_2\text{O}_3$  1.2, 2.0,  $\text{CaO}$  0.5, ign. loss 13.4, 11.0, = 99.9, 99.8. From these results, other with the results of optical, electronoptical, X-ray, d.t.a. measurements, it is concluded that the raw material (figures for a sample purified by elutriation are in brackets) consists of: halloysite (predominant) + illite 76–81% (95–97%), quartz 15–17% (2–3%), vesite 2–4% (—), hematite and other minerals 2–3% (2%). Particle size analysis shows a very high content of material, e.g., 76.2% < 30 $\mu$ , 35.4% < 5 $\mu$ . Plasticity and various technical properties of the kaolin are described and discussed.

R. C. M.

**Палавеев (Т.)** Палавеев (Т.). Бор в черноземах и серых лесных почвах Северной Болгарии. [*Boron in chernozems and grey forest soils of Northern Bulgaria*]. Почвоведение [Pedology], 1958, no. 9, 116–122.

The chernozems and grey forest soils investigated, derived from loess, Pliocene and other clays, contain  $10^{-3}$ – $5.3 \times 10^{-3}\%$  B, more than 4/5 of which is in the form of tourmaline. One soil, a solonchak on the Danube terrace, contains  $16.1 \times 10^{-3}\%$  B. The B content in the surface horizon varies from 68 to 120% of that in the parent material. The water-soluble B in these soils is in the range  $10^{-5}$ – $11 \times 10^{-5}\%$ , the solonchak having  $22.7 \times 10^{-5}\%$ . These results are compared with data for Russian and S.A. chernozems.

R. C. M.

**Ковда (В. А.), Зимовец (Б. А.), & Амчиславская (А. Г.)** Ковда (В. А.), Зимовец (Б. А.) и Амчиславская (А. Г.). О гидrogenной аккумуляции соединений кремнезема и полуторных окислов в почвах Приамурья. [*On the hydrogenic accumulation of silicon compounds and sesquioxides in soils of the Amur river region*]. Почвоведение [Pedology], 1958, no. 5, 1–11.

Analyses of river, spring, well, and ground water show that large amounts of Si, Fe, and Al are brought down from the mountains and hills into the old alluvial plains of the Amur river region. Evaporation and transpiration of this water cause migration of these ions into the sediment and hydrous sesquioxides together with allophanoids result. In a meadow-gley soil profile there is a transition from chromite, kaolinite and amorphous silica (the remains of diatoms) at the surface through highly-weathered hydroxides and smectites to much amorphous allophanoid material at about 2 metres; hydrous oxides of Al and Fe and quartz are accessories throughout. Opaline and iron-manganese concretions occur.

R. C. M.

**[Ronov (A. B.) & Khlebnikova (Z. V.)]** Ронов (А. Б.) и Хлебникова (З. В.). Химический состав важнейших генетических типов глин. [*Chemical composition of the main genetic clay types*] Геохимия, Изд. Акад. Наук СССР [Geochemistry, Publ. Acad. Sci. U.S.S.R.], 1957, no. 6, 449–469, 14 figs.

On the basis of a very large number of chemical analyses of clays, the authors have calculated average compositions of clays belonging to three different facies: (1) continental of cold and moderate climate, (2) continental of hot and moist climate, (3) marine; the average for clays of all facies is also given. By means of frequency curves and triangular diagrams it is shown that the major oxides follow a normal distribution, and the minor oxides a lognormal distribution. Characteristic chemical features of clays of different facies are indicated, also the outlines of their genetic histories, and the intake and outgoing of chemical elements during their formation. A bimodal frequency diagram for alumina shows, for example, the prevalence of two types of clays—low alumina (marine and continental of cold and moderate climate) and high alumina (continental, of hot and moist climate). Many other geochemical deductions and regularities are noted.

S. I. T.

**McMillan (N. J.)**. Petrology of the Nodaway underclay (Pennsylvanian), Kansas. Bull. Kansas Geol. Survey, 1956, 119, 187–249, 10 figs., 4 pls.

In the Forest City basin the Nodaway underclay contains illite, kaolinite, and mixed-layer illite-montmorillonite whereas the underlying shale lacks illite-montmorillonite but has chlorite-like clay. The underclay on the Bourbon arch more closely resembles the underlying shale. Potassium is most concentrated in topmost part of the underclay. Where the coal is thick the amount of K is greater than under thin coal. It is postulated that underclay is 'fossil' gley. Biotite has been altered to chlorite in the poorly developed underclay, but the 'gleying' process has altered chlorite to illite-montmorillonite in the well developed underclay. The report contains X-ray diffraction data for nine clay samples and chemical analyses of 18 samples.

A. Sw.

**Loughnan (F. C.) & See (G. T.)**. A white chlorite from Cobargo, N.S.W. Amer. Min., 1958, 43, 671–676, 1 fig.

Seven samples from the Cobargo, N.S.W., clay deposits were analysed using d.t.a. and X-ray techniques. The

mineral assemblage consists of chlorite, montmorillonite, talc, pulverized feldspar and lesser amounts of vermiculite, mica, and rutile. The chlorite, with an approximate composition of  $\text{Mg}_5\text{Al}(\text{Si}_3\text{Al})\text{O}_{10}(\text{OH})_8$ , had previously been described as pyrophyllite. This mineral assemblage has resulted from magnesium metasomatism of a fine- to medium-grained albitite, a differentiate of the Bega granodiorite. 6 chemical analyses.

B. H. B.

**Quaide (William).** *Clay minerals from salt concentration ponds.* Amer. Journ. Sci., 1958, **256**, 431-437.

Chlorite, montmorillonite, and micas found in muds from San Francisco bay and from nearby salt concentration ponds that have been kept at nearly constant, known conditions of pH, Eh, and (high) salinity, for periods of

7 or 27 years, show no alteration of structure that can be detected by X-ray diffraction. The mica, chlorite, and montmorillonite all originated in older sediments exposed in the surrounding hills. The results do not conflict with the idea of Grim and Bradley that main diagenesis takes place only after deep burial.

H. W.

**Kulbicki (G.).** *Phénomènes de diagenèse dans les sédiments argileux.* Clay Min. Bull., 1954, **2**, 183-188, 10 figs.

Microscopic examination gives valuable data upon diagenetic processes undergone by clays subsequent to deposition. This is illustrated with a set of photomicrographs showing the effect of pressure, the effect of solution and reprecipitation, the formation of montmorillonite from halloysite or kaolinite by the action of siliceous water, and the recrystallization of illite.

R. C. M.

## CRYSTAL STRUCTURE OF MINERALS

**Cochran (W.) & Douglas (A. S.).** *The use of a high-speed digital computer for the direct determination of crystal structures. I.* Proc. Roy. Soc., 1959, **227**, A, 486-500, 3 figs. *II.* Ibid., 1957, **243**, A, 281-288, 3 figs.

Under favourable circumstances the signs of the largest terms in the Fourier series representation of  $\rho$ , the electron density in the unit cell, can be determined directly and the magnitude of these terms can be found by experiment. Techniques for the selection of most probable sets of signs using the EDSAC electronic computer are described.

R. A. H.

**Haas (M.) & Sutherland (G. B. B. M.).** *The infra-red spectrum and crystal structure of gypsum.* Proc. Roy. Soc., 1956, **236**, A, 427-445, 8 figs.

Infra-red spectra of single crystals of gypsum have been obtained between 450 and  $3800\text{ cm}^{-1}$  by measurement of transmission and reflection of plane-polarized radiation on (010), ( $\bar{1}01$ ) and ( $\bar{2}01$ ). The results, together with earlier results on the Raman spectrum of gypsum, make it possible to assign 16 out of the 18 internal fundamental modes of the two sulphate ions, and 10 out of 12 internal modes of the four water molecules in the unit cell. Comparison of the spectra of the sulphate ions and water molecules in gypsum with those given by sulphate ions in solution and water molecules in the gaseous phase provides some information on the nature of the crystalline field. [M.A. 4-158, 6-413]

R. A. H.

**Finch (G. I.), Sinha (A. P. B.), & Sinha (K. P.).** *Crystal distortion in ferrite-manganites.* Proc. Roy. Soc., 1957, **242**, A, 28-35, 7 figs.

The origin of the distortion of spinels from cubic tetragonal symmetry is examined in the case of copper ferrites and a series of manganite-ferrite systems. The degree of distortion is found to depend on the temperature and the net fraction of cations forming appropriately orientated  $d_{sp^2}$  bonds in octahedral sites. [M.A. 5-179]

R. A. H.

**Finch (G. I.) & Sinha (K. P.).** *An electron-diffraction study of the transformation  $\alpha\text{-Fe}_2\text{O}_3$  to  $\gamma\text{-Fe}_2\text{O}_3$ .* Proc. Roy. Soc., 1957, **241**, A, 1-8, 1 fig., 1 pl.

At  $500^\circ\text{C}$  a change occurs in the crystal structure of outgrowths formed on haematite single crystals by heating in air; this change is apparently due to the migration of some cations to tetrahedral interstices. At  $700^\circ\text{C}$  the structure of the outgrowths changes to one characteristic of  $\gamma\text{-Fe}_2\text{O}_3$  and persists as such even after prolonged heating at  $900^\circ\text{C}$ . Thus the transformation  $\gamma\text{-Fe}_2\text{O}_3$  to  $\alpha\text{-Fe}_2\text{O}_3$  is not as has been supposed strictly irreversible. It is concluded that the  $\alpha\text{-}\gamma$  transformation is a necessary step preceding the solid-state spinelization reaction involved in the formation of a ferrosphenel.

R. A. H.

**Cormack (A. M.).** *Fourier transforms in cylindrical coordinates.* Acta Cryst., 1957, **10**, 354-358.



mathematics relevant to calculation of Fourier transforms in polar and cylindrical coordinates with particular reference to the uniform cylinder, the thin cylindrical shell, the helix [applicable to X-ray studies of minerals such as chrysotile and halloysite]. [M.A. 11-174, 12-436, 15, 285] J. Z.

Per (W. T.). *Packing in framework structures*. Acta Cryst., 1956, 9, 764-767.

The topology of framework structures as described recently by Wells [M.A. 13-16, 483] is considered in relation to the packing coefficient. For stacked nets of regular polygons the packing decreases with rank and proportion to the large polygons. In framework silicates, however, the polygons such as the 8-gons in feldspar are stable in collapsed form similar to 6-gons and the resulting decrease in packing may more than offset the topological effect. Four-connected silicate frameworks with packings appreciably greater than that of quartz are unlikely.

P. G.

Reze (Günther). *Zur Röntgenstreuung an unrollständigen zylindrischen Gittern: I and II*. Acta Cryst., 1956, 9, 841-847, 847-854.

The first paper gives a general solution for the diffraction pattern of a curved crystal without any restrictions on the number of atoms on the arc. This results in a more general prior development than is needed for complete cylindrical lattices and leads to a shape transform comparable to that produced for finite crystals.

In the second paper a method for obtaining the position of the main diffraction maxima from complete or incomplete cylindrical lattices with reference to those of plane lattices is developed; it is also shown how the formation of superstructures can occur. The theory of low-angle scattering can be carried over to complete (not closed) cylindrical networks in the same way as for wide angles by a general Fourier development.

P. G.

Rehman (D., Jr.). *Symmetry in reciprocal space*. Acta Cryst., 1956, 9, 318.

P. G.

Rehov (V.). *The choice of the unit cell in the triclinic system*. Acta Cryst., 1956, 9, 319-320.

Rules for the choice of unit-cells to avoid inconvenient values of lattice parameters.

P. G.

McConnell (Duncan). *The so-called "oxygen excess"*. Amer. Min., 1958, 43, 786.

The term 'oxygen excess' implies an excess of the large oxygen anion rather than a deficiency of smaller cations in a crystal structure; this implication is erroneous in most cases. Such terminology as 'oxygen excess' and 'solid solution' should be abandoned in favour of 'cation deficiency' and 'isomorphic variant'.

B. H. B.

Salkovitz (E. I.). *Crystallographic angles for bismuth and antimony*. Journal of Metals, 1956, 8, no. 2, 176-177, 2 tables, 2 figs.

The author clarifies some apparent confusion existing in the literature relative to notation for bismuth and antimony. The structures may be characterized by either a face-centred rhombohedron in which case the axial angle is  $87^{\circ} 34'$  and the lattice parameter  $a$  6.546 Å, or by a primitive rhombohedral cell obtained by taking a set of axes the halves of the face diagonals of the face-centred lattice in which case the axial angle is  $57^{\circ} 14'$  and the lattice parameter  $a$  4.736 Å. The face-centred rhombohedral unit cell is preferred by the author.

R. G. Wls.

Vickers (W.). *Further contribution to the crystallographic angles for bismuth and antimony*. Journal of Metals, 1957, 9, no. 7, 827-828, 2 tables 2 figs.

Reference is made to Salkovitz [see previous abstract]. Tables are given of angles between directions and angles between planes. Since the axial angle is not quite  $90^{\circ}$  these angles are not identical.

R. G. Wls.

Toussaint (J.). *Sur la gerhardtite de Likasi*. Ann. Soc. Géol. Belgique, 1955-56, 79, B, 233-235.

Gerhardtite, orthorhombic, has  $a$  5.60,  $b$  6.07,  $c$  13.83 Å; space group  $P2_12_12_1$ ; unit-cell contains  $4\text{Cu}_2\text{NO}_3(\text{OH})_3$ . Values of  $d_{hkl}$  are given.

J. M.

Toussaint (J.). *Étude thermique (A.T.D.) des silicates hydratés naturels*. Ann. Soc. Géol. Belgique, 1956-57, 80, B, 287-295, 1 fig.

In diopside, planchite, and shattuckite the water is in the state of OH groups free or bound; planchite contains a little adsorbed water. Chrysocolla contains no OH group, it is a gel in course of crystallization. The water of adsorption and of the gel are readily freed above  $110^{\circ}\text{C}$ , but the OH groups require higher temperatures. After the

water has gone the structure is destroyed, and tenorite with cristobalite, accompanied by quartz or tridymite, is formed.

J. M.

**Toussaint (J.) & Mélon (J.).** *Sur la maille de la destinezite.*

Ann. Soc. Géol. Belgique, 1955-56, **79**, **B**, 41-44, 2 figs.

The unit-cell of destinezite has  $a$  9.61,  $b$  10.27,  $c$  7.36 Å,  $\alpha$  81° 45',  $\beta$  108° 1',  $\gamma$  121° 14'. It contains  $2(\text{FePO}_4)\text{Fe}_2\text{O}_3 \cdot 2\text{SO}_3 \cdot 12\text{H}_2\text{O}$ . The microscopic hexagonal layers flattened || (010) are bounded by [100], [101], [10 $\bar{1}$ ], and [001]. J. M.

**Toussaint (J.).** *Sur les mailles de la planchéite et de la shattuckite.* Ann. Soc. Géol. Belgique, 1955-56, **79**, **B**, 111-118.

Planchéite is orthorhombic,  $a$  10.11,  $b$  19.08,  $c$  5.21 Å. The cell contains  $14\text{CuSiO}_3 \cdot 4\text{H}_2\text{O}$ . Shattuckite is orthorhombic, pseudotetragonal, with  $a$  9.91,  $b$  9.91,  $c$  5.21 Å; its cell contains  $8\text{CuSiO}_3 \cdot 4\text{H}_2\text{O}$ . Lattice measurements are given.

J. M.

**Layman (Frederic G.).** *Unit cell and space group of larsenite,  $\text{PbZnSiO}_4$ .* Amer. Min., 1957, **42**, 910-912.

Larsenite from Franklin, New Jersey [M.A. 3-469], is shown not to be isostructural with the olivine group: the  $a$  and  $b$  axes are approximately double those of olivine, while the  $c$  axes are similar. Single crystal X-ray studies on larsenite gave  $a$  8.23,  $b$  18.94,  $c$  5.06, space group  $Pnam$  or  $Pna$ ,  $Z=8$ . Indexed powder spacings are listed. [M.A. 4-16, 6-261]

R. A. H.

**Gabrielson (O.).** *The crystal structure of mendipite,  $\text{Pb}_3\text{O}_2\text{Cl}_2$ .* Arkiv. Min. Geol. Stockholm, 1957, **2**, 299-304, 1 fig.

A determination of the structure of mendipite,  $\text{Pb}_3\text{O}_2\text{Cl}_2$  has been carried out by the trial-and-error method. Weissenberg photographs show that the mineral belongs to the space group  $P2_12_12_1$  and has the lattice constants  $a$  9.52,  $b$  11.95, and  $c$  5.87 Å. The cell contains four molecules  $\text{Pb}_3\text{O}_2\text{Cl}_2$ . The parameters are:

4 Pb <sub>I</sub>	in $x=0.119$ , $y=0.219$ , $z=0.250$
4 Pb <sub>II</sub>	in $x=0.335$ , $y=0.082$ , $z=0.750$
4 Pb <sub>III</sub>	in $x=0.453$ , $y=0.437$ , $z=0.250$
4 O <sub>I</sub>	in $x=0.645$ , $y=0.430$ , $z=0.000$
4 O <sub>II</sub>	in $x=0.645$ , $y=0.430$ , $z=0.500$
4 Cl <sub>I</sub>	in $x=0.370$ , $y=0.520$ , $z=0.750$
4 Cl <sub>II</sub>	in $x=0.465$ , $y=0.195$ , $z=0.250$

$\text{Pb}_6\text{O}_4$  tetrahedra form infinite chains in the direction of the  $c$ -axis. These chains are laterally held together by the

Pb-Cl bonds. Judging from the length of the bonds, Pb-O bonds seem to be chiefly of covalent character, the Pb-Cl bonds of chiefly ionic character.

E. V.

**Takéuchi (Yoshio).** *The crystal structure of vonse* Min. Journ. [Japan], 1956, **2**, 19-26, 5 figs.

The cell parameters of iron-rich ludwigite (vonse) were determined as  $a$  9.730,  $b$  12.357,  $c$  3.055 Å, cell contains 8(Fe,Mg)O.2B<sub>2</sub>O<sub>3</sub>, space group  $Pbam$ . The structure is essentially the same as that obtained previously for ludwigite [M.A. 11-242], but the new intensity data provide more accurate interatomic distances. The mean Fe<sup>2+</sup>-O distance is 2.16 Å, and the mean Fe<sup>3+</sup>-O distance 2.0 Å. The boron tetrahedra are slightly distorted, with one C-O edge 10% shorter than the others.

R. A. L.

**Takéuchi (Y.).** *The interpretation of X-ray powder diffraction patterns of the szaibelyite-sussexite series.* Journ. [Japan], 1957, **2**, 78-89, 3 figs.

Szajbelyite from Douglas Lake, British Columbia, material originally named camsellite [M.A. 1-375], has  $a$  10.34 Å,  $b$  12.45,  $c$  3.21 Å,  $Z=8$ , sp. gr. (calc.) 2.75, while the manganese analogue sussexite from Mine Hill, Sussex County, New Jersey [M.A. 4-182], has  $a$  10.61 Å,  $b$  12.45,  $c$  3.30 Å,  $Z=8$ , sp. gr. (calc.) 3.22. The X-ray powder diffraction patterns are indexed, as also is the powder pattern of Gruner [M.A. 5-201] for magnesiosussexite, giving for the latter  $a$  10.46 Å,  $b$  12.52,  $c$  3.24 Å. An unanalysed szajbelyite from Ta-huang-kon, Kuan-tien-hsien, Manchuria, has interplanar spacings indicating a close approach to the composition of the pure end-member  $\text{MgHBO}_3$ . [M.A. 3-4-143, 7-122, 463, 9-123, 11-299]

R. A. L.

**Takéuchi (Y.).** *The absolute structure of ullmanite,  $\text{NiSbS}_2$ .* Min. Journ. [Japan], 1957, **2**, 90-102, 8 figs., 2 pls.

A crystal of ullmanite from Sakhendorf, Siegerland, has  $a$   $5.88 \pm 0.002$  Å, space group  $P2_13$ ,  $Z=4$ , sp. gr. (calc.) 6.90. The bond distances are Ni-Sb 2.57 Å, Sb-S 2.57 Å, Ni-S 2.34. The structure may be compared with that of pyrite, the S<sub>2</sub> group in the latter being replaced by SbS<sub>2</sub>, so that the Ni atom is surrounded by six neighbours consisting of three Sb and three S atoms. [M.A. 3-19]

R. A. L.

**Kokkoros (P. A.) & Rentzeperis (P. J.).** *The crystal structure of the anhydrous sulphates of copper and zinc.* Cryst., 1958, **11**, 361-364, 1 fig.



$\text{CaSO}_4$  [hydrocyanite] and  $\text{ZnSO}_4$  [zinkosite?] are isostructural. They are orthorhombic  $Pnma$ , with  $a$  8.39, 8;  $b$  6.69, 6.73;  $c$  4.83, 4.77 Å respectively;  $Z=4$ .

J. Z.

**aglio (M.).** *Die Kristallstruktur von  $\text{Na}_2\text{Zn}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$  (Zn-Blödit).* Acta Cryst., 1958, **11**, 789–794, 2 figs.

The structure of  $\text{Na}_2\text{Zn}(\text{SO}_4)_2 \cdot 4\text{H}_2\text{O}$ , prepared from  $\text{SO}_4 \cdot 7\text{H}_2\text{O}$  and  $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ , was determined by Patterson and isomorphous replacement methods using the analogous compound, Mg-blödit. Zn-blödit is monoclinic  $P2_1/a$ , with  $a$  11.05,  $b$  8.23,  $c$  5.54 Å,  $\beta$  100° 35',  $Z=2$ ,  $D$  meas. 2.511 g/cc. at 20°C. Ni-, Co- and Fe-blödit are isostructural, and the latter has  $a$  11.42,  $b$  8.25,  $c$  5.55 Å,  $\beta$  100° 30'. The structure contains  $\text{SO}_4$  tetrahedra the oxygens of which also take part in octahedral coordination about Zn and Na atoms. [M.A. 14–26] J. Z.

**attow (G.).** *Die Kristallstruktur von  $\text{CuSeO}_3 \cdot 2\text{H}_2\text{O}$  (chalkomenit).* Acta Cryst., 1958, **11**, 377–383, 2 figs.

Artificially prepared  $\text{CuSeO}_3 \cdot 2\text{H}_2\text{O}$  is orthorhombic,  $C2_22_1$ , with  $a$  6.67,  $b$  9.19,  $c$  7.38 Å,  $Z=4$ . Copper atoms are octahedrally coordinated by oxygens and  $\text{H}_2\text{O}$  molecules, and the octahedra are linked by  $\text{H}_2\text{O}$  molecules to form chains parallel to the  $b$  axis. The  $\text{SeO}_3$  groups form trigonal pyramids with mean Se–O distance 1.76 Å. [M.A. 54, 12–402] J. Z.

**ones (D. A.) & Smith (T.).** *An X-ray study of the structure of a sodium chloride crystal grown by the Kyropoulos method.* Proc. Phys. Soc., 1956, **69B**, 878–884, 4 figs.

The crystallite structure of a halite crystal grown with a varying growth velocity has been investigated. The crystallites are shown to be axial in form, their major misorientation corresponding to a rotation about the boule axis. R. A. H.

**ischmeister (H. F.).** *The thermal expansion of sodium chloride and some other alkali halides at high temperatures.* Acta Cryst., 1956, **9**, 416–420.

X-ray measurements of the thermal expansion of NaCl up to the melting point are reported. The observed non-linearity of the thermal expansion of the alkali halides is in accord with the Grüneisen lattice-dynamical theory and could not be caused by lattice defects. P. G.

**Candlin (Rosemary).** *Thermal changes in the structure of sodium sesquicarbonate.* Acta Cryst., 1956, **9**, 545–554.

Accurate structure determinations of sodium sesquicarbonate in projection on (010) have been carried out at 18°C and –170°C. P. G.

**Loopstra (Lidy H.) & MacGillavry (Caroline H.).** *The crystal structure of  $\text{KHSO}_4$  (mercallite).* Acta Cryst., 1958, **11**, 349–354, 3 figs.

Mercallite is orthorhombic,  $Pbca$ , with  $a$  8.40,  $b$  9.79,  $c$  18.93 Å,  $Z=16$ , and  $D$  2.322 g/cc. Some  $\text{SO}_4$  tetrahedra are linked by hydrogen bonds forming chains in the  $a$  direction, and others form dimers across a symmetry centre. K atoms, in ninefold coordination, link  $\text{SO}_4$  groups to form a three dimensional network. [M.M. 24–618; M.A. 6–148] J. Z.

**Sass (Ronald L.), Vidale (Rosemary), & Donohue (Jerry).** *Interatomic distances and thermal anisotropy in sodium nitrate and calcite.* Acta Cryst., 1957, **10**, 567–570, 1 fig.

Accurate determinations of bond distances yield C–O 1.294 Å, N–O 1.218 Å (standard deviation 0.004 Å). J. Z.

**Busing (W. R.) & Levy (H. A.).** *A single crystal neutron diffraction study of diaspore,  $\text{AlO}(\text{OH})$ .* Acta Cryst., 1958, **11**, 798–803, 3 figs.

Neutron diffraction has been used to re-determine the crystal structure of diaspore and in particular to locate the hydrogen atoms. Al and O positions agree well with those determined by Hoppe [M.A. 8–283]. Bond angles, interatomic distances, and individual temperature factors are given. It is seen that the hydrogen atom between hydrogen bonded oxygens lies closer to one of them and is not co-linear with them. Re-determination of cell parameters gives  $a$  4.401 ± 0.001,  $b$  9.421 ± 0.004,  $c$  2.845 ± 0.001 Å. Crystals from Redondo, Uruguay and Chester, Pennsylvania, were used in the investigation [M.A. 6–175]. J. Z.

**Ferguson (R. B.), Traill (R. J.), & Taylor (W. H.).** *The crystal structures of low-temperature and high-temperature albites.* Acta Cryst., 1958, **11**, 331–348, 5 figs.

The two structures have been refined by means of Fo and (Fo–Fe) Fourier projections parallel to all three axes. Average bond lengths show that in low-temperature albite one of the four non-equivalent tetrahedral sites contains

nearly all of the Al in  $\text{NaSi}_3\text{AlO}_8$ , and that in high-temperature albite the Si and Al atoms are randomly distributed. In both albites the sodium atom appears to have anisotropic thermal vibration with maximum amplitude nearly along  $b$ . In high-temperature albite the effect is more marked and is equivalent to an atomic separation of about  $0.6\text{\AA}$ . It may be that the sodium atom occupies at random one or other of two positions separated by this distance. Local charge balance is calculated for the two structures and for the potassium feldspars and is taken as a measure of stability. It is suggested that the most stable feldspar structure is not necessarily the most ordered with respect to (Si,Al) and that in particular the partially ordered monoclinic orthoclase rather than microcline is the most stable potassium feldspar. A possible origin for microcline is discussed. [M.M. 25-498; M.A. 6-177, 11-427] J. Z.

**Chayes (F.).** *A possible explanation of the  $\delta_c$  separations in intermediate plagioclase.* Acta Cryst., 1958, **11**, 323-324, 1 fig.

The variation in  $\delta_c$ , the separation of subsidiary layer lines from main layer lines in intermediate plagioclase  $c$  axis X-ray photographs, is that which would be expected if it were controlled by the average run lengths of Al and Si at complete short-range disorder in the  $c$  direction. [M.M. 31-21] J. Z.

**Posner (A. S.), Perloff (Albin), & Diorio (Alfred F.).** *Refinement of the hydroxyapatite structure.* Acta Cryst., 1958, **11**, 308-309.

Powder data for synthetic hydroxyapatite gave  $a$   $9.43_2$ ,  $c$   $6.88_1\text{\AA}$ . Refinement of atomic parameters was carried out by least squares methods applied to three-dimensional data, and bond lengths have been recalculated and compared with previous values. [M.M. 27-254; M.A. 4-462, 5-316] J. Z.

**Abrahams (S. C.) & Geller (S.).** *Refinement of the structure of a grossularite garnet.* Acta Cryst., 1958, **11**, 437-441, 1 fig.

Grossular, from Chihuahua, Mexico, is cubic,  $Ia3d$ , with  $a$   $11.874 \pm 0.004\text{\AA}$ ,  $Z=8$ , and  $D$   $3.576\text{ g/cc}$ . Chemical analysis by E. Bloom, Jr., gave  $\text{SiO}_2$  38.83,  $\text{TiO}_2$  0.33,  $\text{Al}_2\text{O}_3$  18.84,  $\text{Fe}_2\text{O}_3$  4.36,  $\text{MgO}$  2.55,  $\text{CaO}$  34.81, =99.72, with 0.01 to 0.3% Mn impurity. The coordinates of oxygen atoms have been accurately re-determined and yield interatomic distances: Si-O  $1.64$ , Al-O  $1.95$ , Ca-O  $2.33$  and  $2.49\text{\AA}$  (all  $\pm 0.2\text{\AA}$ ). The irregularities of the oxygen

polyhedra are compared with those in yttrium-iron garnet and are used to predict structural relationships in uvarovite and andradite. [M.A. 4-111, 14-23] J. Z.

**Rentzeperis (P. J.).** *The unit cell and space group of hodgkinsonite.* Acta Cryst., 1958, **11**, 448.

Hodgkinsonite,  $\text{MnZn}_2(\text{OH})_2\text{SiO}_4$ , is monoclinic  $P2_1$ , with  $a$   $8.17$ ,  $b$   $5.31$ ,  $c$   $11.76\text{\AA}$ ,  $\beta$   $95^\circ 28'$ ,  $Z=4$ ,  $D$  (calc.)  $4.08\text{ g/cc}$ . Structure determination is in progress. J. Z.

**Donohue (J.), Miller (S. J.), & Cline (F.).** *The effect of various substituents on the lattice constants of tetragonal barium titanate.* Acta Cryst., 1958, **11**, 693-695, 4 figs.

$\text{BaTiO}_3$  is tetragonal with  $a$   $3.993_9$ ,  $c$   $4.034_6\text{\AA}$  at  $24 \pm 5^\circ$ . Substitution of  $\text{SnO}_2$  or  $\text{CaSnO}_3$  reduces  $c$  and increases  $a$ , the lattice becoming cubic at 9 mol. per cent.  $\text{SnO}_2$  and 13 mol. per cent.  $\text{CaSnO}_3$ . Addition of  $\text{TiO}_2$  has no measurable effect. J. Z.

**Hanson (A. W.).** *The crystal structure of nolanite.* Acta Cryst., 1958, **11**, 703-709, 3 figs.

Nolanite (approximate formula  $\text{Fe}^{2+}_{2.5}\text{V}_{1.5}^{3+}\text{V}_6^{4+}\text{O}_{16}$ ) is hexagonal, probably  $P6_3mc$ , with  $a$   $5.85$ ,  $c$   $9.29\text{\AA}$ ,  $Z=6$ . The structure consists of a close-packed hexagonal (ABA) framework of 16 oxygen ions with metal ions in some of the interstices.  $\text{V}^{4+}$  ions are octahedrally coordinated while  $\text{Fe}^{2+}$  and  $\text{V}^{3+}$  ions are distributed among octahedral and tetrahedral sites. Results obtained with different radiations suggest that vanadium occupies mainly tetrahedral sites. [M.A. 12-95, 210, 13-661] J. Z.

**Karle (J.), Hauptman (H.), & Christ (C. L.).** *Phase determination for colemanite,  $\text{CaB}_3\text{O}_4(\text{OH})_3 \cdot \text{H}_2\text{O}$ .* Acta Cryst., 1958, **11**, 757-761, 1 fig. J. Z.

**Evans (Howard T., Jr.) & Mrose (Mary E.).** *The crystal structures of three new vanadium oxide minerals.* Acta Cryst., 1958, **11**, 56-58, 1 fig.

Häggite,  $\text{V}_2\text{O}_2(\text{OH})_3$ , is monoclinic,  $C2/m$  with  $a$   $12.17 \pm 0.05$ ,  $b$   $2.99 \pm 0.01$ ,  $c$   $4.83 \pm 0.02\text{\AA}$ ,  $\beta$   $98^\circ 15' \pm 5'$ . Doloresite,  $\text{V}_3\text{O}_4(\text{OH})_4$ , is monoclinic,  $C2/m$ , with  $a$   $19.64 \pm 0.06$ ,  $b$   $2.99 \pm 0.01$ ,  $c$   $4.83 \pm 0.02\text{\AA}$ ,  $\beta$   $103^\circ 55'$ . The cell parameters for duttonite are also given [M.A. 13-379]. The structures are briefly described but further details are to be published later. [M.M. 31-957, 961; A.M. 42-587, 43-385, 62-14-59] J. Z.



**Hittaker (E. J. W.).** *The structure of chrysotile. II. Clino-chrysotile. III. Ortho-chrysotile. IV. Para-chrysotile.* Acta Cryst., 1956, **9**, 855–862, 862–864, 865–867.

Clino-chrysotile is based on a cylindrical lattice of type

The specimen most extensively examined is monoclinic with  $a$  14.65,  $b$  approx. 9.25,  $c$  5.34 Å,  $\beta = 93^\circ 16'$  is confirmed that the structure is based on kaolin-like layers attached in a manner consistent with a cylindrical structure. Ortho-chrysotile is also based on a cylindrical lattice of type  $C_2$ . The specimen studied in most detail is orthorhombic with  $a$  14.63,  $b$  approx. 9.2,  $c$  5.34 Å. The individual layers in the structure are almost identical with those in clino-chrysotile but alternate layers are inverted end to end. This leads to a different stacking arrangement, which is still consistent with a cylindrical structure. Parachrysotile has an orthorhombic cylindrical lattice with  $a$  14.7  $\pm$  0.1,  $b$  9.24  $\pm$  0.02,  $c$  approx. 5.3 Å. The structural principles established for ortho- and clino-chrysotile are shown to apply to para-chrysotile also. P. G.

**Hama (Th. G.) & Hytönen (K.).** *Unit cell of mosandrite, johnstrupite and rinkite.* Geol. Fören. Förh. Stockholm, 1957, **79**, 791–796, 1 fig.

A re-examination of Brögger's original material [Zeits. Krist., 1890, **16**] of mosandrite and johnstrupite has been made. For comparison some new data for rinkite from Angerdluarsuk are given. Rotation and Weissenberg photographs show that the minerals are triclinic and pseudomonoclinic. The unit cell dimensions of mosandrite and johnstrupite (upper row) (with interchanged  $b$  and  $c$  axes) and the setting of Brögger) and of rinkite (lower row) are:

$a$	$b$	$c$	$\alpha$	$\beta$	$\gamma$
13.45 $\pm$ 0.06	7.44 $\pm$ 0.03	5.63 $\pm$ 0.02	90.2°	91.0°	100.9°
13.51 $\pm$ 0.1	7.45 $\pm$ 0.03	5.64 $\pm$ 0.03	90°	91°	101°

Calculations of the unit cell contents from analyses by Brögger and Böggild (Medd. om Grönland, **149**, 1953) give the following formulae: mosandrite  $(\text{Ca,Ce,Na})_8(\text{Ti,Zr})_2\text{O}_{32}\text{H}_{12}\text{F}_{1-2}$ , johnstrupite  $(\text{Ca,Na,Ce})_{12}(\text{Ti,Mg,Al,Zr})_3\text{O}_{31}\text{H}_2\text{F}_{4-5}$ , and rinkite  $(\text{Ca,Na,Ce})_{12}(\text{Ti,Zr})_2\text{Si}_7\text{O}_{31}\text{H}_6\text{F}_4$ . The authors conclude that mosandrite and johnstrupite

are varieties of the same species which shows a relationship to the wollastonite-pectolite family. Rinkite differs from the mosandrite group in the powder pattern and is regarded as a separate species. [M.A. 12–199] E. W.

**Christ (C. L.) & Clark (J. R.).** *The structure of meyerhofferite,  $2\text{CaO} \cdot 3\text{B}_2\text{O}_3 \cdot 7\text{H}_2\text{O}$ , a P1 crystal, determined by the direct method of Hauptman and Karle.* Acta Cryst., 1956, **9**, 830.

A preliminary account.

P. G.

**Christ (C. L.), Clark (J. R.), & Evans (H. T., Jr.).** *Studies of borate minerals (III): The crystal structure of colemanite,  $\text{CaB}_3\text{O}_4(\text{OH})_3\text{H}_2\text{O}$ .* Acta Cryst., 1958, **11**, 761–770, 5 figs.

Colemanite is monoclinic  $P2_1/a$  with  $a$  8.743,  $b$  11.264,  $c$  6.102 Å,  $\beta$  110° 7',  $D$  2.42 g/cc,  $Z=4$ . The structure was determined by the statistical method of Karle & Hauptman [see previous abstract]. The structure contains infinite chains parallel to  $a$  linked laterally by Ca ions to form sheets parallel to (010), which in turn are connected by a hydrogen bond system. The chain element  $[\text{B}_3\text{O}_4(\text{OH})_3]^{2-}$  consists of a  $\text{BO}_3$  triangle, a  $\text{BO}_3(\text{OH})$  tetrahedron, and a  $\text{BO}_2(\text{OH})_2$  tetrahedron. The ferro-electric property of colemanite below about 2.5–6°C is attributed to the ordering of hydrogen atoms. [M.A. 12–208, 434, 13–378, 14–61]

J. Z.

**Morimoto (Nobuo).** *The crystal structure of borax.* Min. Journ. [Japan], 1956, **2**, 1–18, 5 figs.

The unit cell of recrystallized commercial borax ( $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ ) had  $a$  11.858,  $b$  10.674,  $c$  12.197 Å,  $\beta$  106° 41',  $Z=4$ , space group  $C_{2h}^6$ . The structure is composed of chains of regular octahedra, formed by water molecules around sodium atoms, running parallel to the  $c$ -axis. These chains, of composition  $\text{Na}_2 \cdot 8\text{H}_2\text{O}$ , build up a sheet holding isolated groups of  $\text{B}_4\text{O}_5(\text{OH})_4$  between them through hydrogen bonds: these sheets also are held together mainly by hydrogen bonds, and lie parallel to (100). The structural formula thus may be represented as  $\text{B}_4\text{O}_5(\text{OH})_4 \cdot \text{Na}_2 \cdot 8\text{H}_2\text{O}$ . [M.A. 6–335] R. A. H.

## ECONOMIC MINERALOGY AND ORE DEPOSITS

**Howie (S. H. U.) & Taylor (K.).** *A system of ore mineral identification.* Mining Mag., 1958, **99**, 265–277, 337–345, 8 figs.

A system is proposed for ore mineral identification by means of accurate measurements of hardness and reflec-

tivity, taken together with other readily observable properties such as colour, anisotropism, polarization colours, and bireflection. The techniques for the accurate measurement of reflectivity and hardness are described [M.M. 31–476] and lists are given of minerals arranged in order of

increasing reflectivity and increasing hardness: variation in hardness in the same mineral from different localities is also discussed. A plot of mean values of reflectivity against hardness for 103 ore minerals allows the identification of many common ore minerals by these two properties alone. Determinative tables are also given, however, including these properties and also colour, anisotropism, predominant polarization colours in the 45° position, and internal reflections.

R. A. H.

[Godovikov (A. A.) & Kudryakova (V. A.)] Годовиков (А. А.) и Кудрякова (В. А.). О некоторых особенностях процесса окисления шмальтин — хлоантита. [*On certain features of smaltite-chloanthite oxidation*]. Изв. Акад. Наук СССР Сер. Геол. [Bull. Acad. Sci. U.R.S.S., Sér. Géol.], 1958, no. 10, 37–45, 5 figs.

On the basis of a number of spectroscopic, chemical and X-ray analyses of zoned smaltite-chloanthite crystals, it is concluded that the zones differ greatly in their composition and properties. It is also concluded that on oxidation only the skutterudite component remains stable and that its accumulation on partly oxidised zones or pockets may lead to enrichment in cobalt.

S. I. T.

[Shamrai (I. A.) & Sorochinskaya (V. I.)] Шамрай (И. А.) и Сорочинская (В. И.). Минералогия и условия формирования керченских железных темно-зеленых руд. [*The mineralogy and conditions of formation of the dark-green iron ores of Kerch*]. Доклады Акад. Наук СССР. [C.R. Acad. Sci. U.S.S.R.], 1958, 120, 875–878, 2 figs.

The main Kerch iron ore is a dark oolitic and pisolithic ore in which the ooliths and pisoliths are composed of ferric minerals—hydrogoethite, goethite and lepidocrocite—while the ferrous cement is of chamosite. Ferric minerals were deposited during the primary sedimentation stage, and the cementing material was formed during the diagenetic stage, probably under the reducing influence of decaying organic matter.

S. I. T.

[Melnik (Y. P.)]. Мельник (Ю. П.). Случай перехода маритовых руд в магнетитовые в саксаганском районе Криворожского бассейна. [*A case of transition of martite ores into magnetite ores in the Saksagan region of the Krivoy Rog basin*]. Доклады Акад. Наук СССР. [C.R. Acad. Sci. U.S.S.R.], 1958, 120, 1095–1098, 2 figs.

The intensely folded quartz-magnetite and silicate-

magnetite ores of this region are greatly oxidised in the upper zones as shown by the transformation of magnetite into martite. Several chemical analyses of ores are given.

S. I. T.

[Offman (P. E.)] Оффман (П. Е.). О вулканических трубчатых частях Сибирской платформы и о происхождении железных руд, приуроченных к этим трубкам. [*On volcanic pipes of the southern part of the Siberian platform and on the origin of iron ores associated with these pipes*]. Изв. Акад. Наук СССР. Сер. Геол. [Bull. Acad. Sci. U.S.S.R. Sér. Géol.], 1957, no. 10, 15–24, 4 figs.

The volcanic pipes of the Angara-Ilim district are discussed and volcanic tuffs, skarns and iron ores are described. The origin of the ore is discussed.

S. I. T.

[Pavlov (N. V.)] Павлов (Н. В.). Вопросы генезиса эндогенных магнетитовых руд Тунгусской синеклизы Сибирской платформы. [*On the genesis of endogenic magnetite ores of the Tunguska syncline of the Siberian platform*]. Изв. Акад. Наук СССР, Сер. Геол. [Bull. Acad. Sci. U.R.S.S., Sér. Géol.], 1958, no. 9, 3–24, 8 figs.

Magnetite and magnomagnetite veins and lenses from three Siberian localities, Angara-Katanga, Angara-Vilui and Vilui-Kotui, are described. The ores are intruded into shatter zones penetrated by intrusive basic igneous rocks of the "Siberian traps" formation and are assumed to be derived from the same basic magma. The iron ores are often found in close proximity to the ancient salt deposits and it is suggested that they were originally transported as chlorides and fluorides of iron produced by the action of the magma on salt deposits. The paragenesis of the minerals and the genesis of ores are discussed in detail.

S. I. T.

[Bezsmertnaya (M. S.) & Gorzhevsky (D. I.)] Безсмертная (М. С.) и Горжевский (Д. И.). Околорудные изменения полиметаллических месторождений Рудного Алтая. [*Near-ore alterations of polymetallic deposits of the Rudny Altai*]. Изв. Акад. Наук СССР, Сер. Геол. [Bull. Acad. Sci. URSS, Sér. Géol.], 1958, no. 10, 21–36, 3 figs.

In this particular deposit three thermal metasomatic stages are distinguished: high temperature — skarns; intermediate temperature — epidote-actinolite rocks; low temperature — chloritoides, sericitoides, listwenites. The processes of metasomatism involved are discussed.

S. I. T.



**dkvist (D. V.)** Рундквист (Д. В.). Приоткрывания трещин в процессе формирования прожилков. [*The re-opening of fissures in the process of formation of veinlets*]. Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1957, **86**, 347–354, 8 figs.

This is a study of repeated re-opening of vein fissures of the paragenesis of minerals in the cassiterite-bearing hydrothermal veins of the Mikoyan deposit of Maly Khingan Siberia. S. I. T.

**Guignon (P.) & Toussaint (J.)**. Caractères minéralogiques d'hématites manganésifères d'Ardenne. Ann. Soc. Géol. Belgique, 1954–55, **78**, B, 419–426, 1 fig.

The hematites of the Ardennes leave a black streak on steel when they are particularly rich in Mn (anal. B and C), otherwise the streak is brown-red (A, D, and E).

Locality	Fe	Mn	SiO <sub>2</sub>	CaO	P
Vielsalm	68.7	0.39	0.8	n.d.	0.028
Bihain	39.6	17.64	9.4	0.5	—
do.	42.3	16.84	5.8	0.3	0.033
do.	68.0	0.24	2.4	n.d.	0.028
Regné	66.2	0.24	2.8	n.d.	0.033

SiO<sub>2</sub> from interstitial quartz. TiO<sub>2</sub> absent.

The composition of B and C is that of a bixbyite, but the crystal is a cubic mineral whereas the crystals from Bihain are a Debye-Scherrer diagram identical with that of magnetite. No magnetite is included. This high content of Mn in a hematite does not seem to have been reported and is an interesting problem. J. M.

**Hard (H.)**. Quelques observations sur des filons zonaires pegmatitiques à Manono. Ann. Soc. Géol. Belgique, 1954–55, **78**, fasc. spéc., 41–49, 3 figs.

Two flat veins break off from the north of the dyke of magnetite at Manono (Katanga). They are zoned, with the main phases of deposition. Spodumene is described. Heavy minerals are: cassiterite, tantalum-columbite, zircon, monazite, pyrite, galena. The ratio Ta<sub>2</sub>O<sub>5</sub>/ZrO<sub>2</sub> varies from 0.45 to 0.70 for the whole dyke, and from 1 to 1.8 for the veins. J. M.

**Kun (N.)**. Les pegmatites du Nord Lugulu. Ann. Soc. Géol. Belgique, 1954–55, **78**, fasc. spéc., 27–30, 1 fig.

North Lugulu, Belgian Congo, stretches from Maniema to Kivu. Tin-bearing pegmatites with cassiterite, columbite, tourmaline and sometimes mica, tantalum-bearing pegmatites with ixiolite, tantaliferous cassiterite or ainalite, and zircon-bearing with spodumene are described. J. M.

**Lhoest (A.)**. Les différents types de filons de la concession Somuki à Rutongo (Ruanda). Ann. Soc. Géol. Belgique, 1956–57, **80**, 503–530, 16 figs.

Three types of quartz veins are described: stanniferous veins of radial type; unmineralized sill-type veins; stanniferous joint-veins. The mineralization is associated with a granitic mass. A hypothesis on the genesis of the joint-veins and their infilling is proposed. J. M.

**Kear (D.)**. Kauaeranga sulphide deposit, Thames. New Zealand Journ. Sci. Techn., 1957, **38** (sect. B), 483–495, 3 figs.

Upper Tertiary carbonaceous sediments and andesitic rocks in the Kauaeranga valley (near Thames, Auckland province) have been mineralized, by replacement, with pyrite and marcasite. The mechanism of mineralization and the economic prospects of the deposit as a source of sulphur are discussed. W. A. W.

**Reed (J. J.)**. Granites and mineralization in New Zealand. New Zealand Journ. Geol. Geophys., 1958, **1**, 47–64, 2 figs.

Granites in New Zealand are confined to South and Stewart Islands. The major occurrences are in the north-west part of the South Island (Nelson province), where three north-south trending belts are recognized. The most easterly of these belts is characterized by a granite rich in soda as compared with the two other belts. Further south isolated granite masses are known at various points along the west side of the Island (Westland province), in the south-west part of the Island (Fiordland region), and at Stewart Island. Mineral deposits that are (a) definitely, (b) probably, and (c) possibly related to granite are separately listed and described briefly. The deposits include a wide range of metallic minerals; nearly all, however, occur in small quantities only. Present knowledge of the age of the granites and mineralization is summarised in a table. W. A. W.

**Calembert (L.)**. Structure et minéralisation de la montagne de Pallières (Gard, France). Ann. Soc. Géol. Belgique, 1957–58, **81**, B, 39–68, 9 figs.

Stratigraphy and tectonics of the lead-zinc region of Pallières are described. The conditions under which mineralization took place are specially studied. It is probable that the sulphides had a sedimentary origin but there

were important, and perhaps multiple migrations. The country-rocks are dolomite, sandstones, sandy limestones, conglomerates, and marls. The most general paragenesis is : pyrite and marcasite, blende, galena, pyrite ; there occur also cerussite, melnikovite, pyrite, tetrahedrite, bournonite.

J. M.

**Taylor (J. H.).** *The formation of supergene galena at Broken Hill, Northern Rhodesia.* Min. Mag., 1958, **31**, 908-913, 1 pl.

Lead-zinc ore-bodies in dolomite at Broken Hill consist of a sulphide core surrounded by an oxidized sheath. Oxidation persists to a depth of at least 1150 ft. below surface, and in the transitional zone between sulphide and oxidized ore galena forms a thin rim to relict masses of sphalerite. Further into the sulphide core it penetrates the sphalerite along cracks and cleavages. From its relations to smithsonite and willemite the galena is considered to be supergene in origin and must have been deposited above the water table : such migration of lead in the zone of weathering is believed to have occurred during a former period of aridity. [M.M. 15-1, 21-388 ; M.A. 6-368, 12-554]

R. A. H.

**Sanchez-Mejorada (P.).** *Mineralized Cretaceous horizons in north-eastern Mexico.* Mining Engineering, A.I.M.E., New York, 1958, **10**, 108-111.

The stratigraphic locations of lead-silver replacement deposits are given and six deposits are described briefly. Most ores are oxidized.

R. G. W.

**Skinner (Brian J.).** *Minium from Broken Hill, New South Wales.* Min. Mag., 1958, **31**, 947-950, 1 fig.

Minium is reported from the central portion of the Broken Hill mining field, as scarlet pseudomorphs after cerussite, formed during fires in the mines. It is tetragonal,  $a$  8.824 Å,  $c$  6.564 ; sp. gr.  $8.2 \pm 0.2$  ; chemical analysis gave Pb 89.94, Fe 0.2, Zn 0.1, CO<sub>2</sub> abs. (theoretical Pb content for Pb<sub>3</sub>O<sub>4</sub> 90.67). The indexed X-ray powder diffraction data are tabulated. [M.A. 9-43, 10-530]

R. A. H.

**Muta (K.).** *On the pyromorphite-mimetite series found in Japan.* Journ. Min. Soc. Japan, 1956, **3**, 20-31.

The relations between minor components and crystal habit, colour, and paragenesis for minerals of the pyromorphite series were examined. In general red or violet-brown varieties are characterized by large  $x$  faces and are richer in

Cu, V or Ca, and poorer in Fe than the yellow or green varieties. The minor components in the series reflect the nature of the ore deposit and may be useful in the estimation of the latter.

R. A. H.

**Willman (H. B.), Reynolds (R. R.), & Herbert (Paul, J.).** *Geological aspects of prospecting and areas for prospecting in zinc-lead district of north-western Illinois.* Ill. State Geol. Survey Rept. Invest. 116, 1946, 48 pp.

The lead and zinc ores occur in the Galena, Decorah, and Platteville formations of the Ordovician system. The zinc mineral is largely sphalerite. Where the deposits occur above water level, the zinc sulfide has been partially, in places almost entirely oxidized to zinc carbonate, smithsonite. Where lead occurs alone, iron sulfides are absent but where zinc is present, iron sulfide is also present. The authors favor a magmatic origin for the solutions depositing the ore bodies.

W. A. Wh.

**Childs (Mark S.).** *Geology and development at Friedensville, Pa.* Mining Engineering, A.I.M.E. New York, 1958, **9**, 56-60.

Sphalerite and pyrite ores with dolomite and quartz in the Beekmantown formation.

R. G. W.

**Butler (B. S.) & Vanderwilt (J. W.).** *The Climax molybdenum deposit of Colorado.* Proc. Color. Sci. Soc., 1931, **1**, 309-353, 2 figs, 1 pl. (map).

The Climax molybdenum deposit occurs in altered Precambrian granite and has the shape of a cone, enlarging downwards. The ore mineral is molybdenite in small crystals in veins with quartz and, locally, orthoclase gangue. In the ore zone pyrite, fluorite, and topaz are widespread and fine crystalline ; chalcopyrite, hubnerite, and sphalerite are only locally common. Secondary minerals, other than hydrated iron oxides, are jarosite and molybdite. Minerals in small widely scattered veins post-dating the molybdenum deposit in approximate order of abundance are : quartz, pyrite, sphalerite, galena, hubnerite, fluorite, brown carbonate, and magnetite.

B. H. B.

**[Polyakova (O. P.)]** Полякова (О. П.). Геокронит Смирновского месторождения (Восточное Забайкалье) [Geocronite from the Smirnovsky deposit (eastern Transbaikalian region)] Труды Минер. Муз. Акад. Наук СССР [Trans. Min. Mus. Acad. Sci. U.S.S.R.], 1957, **1**, 99-107, 6 figs.



two generations of geocronite are formed in the Smirky metasomatic hydrothermal deposit formed on a stone. Each generation is characterized by its specific assemblage of minerals. Analysis of geocronite gave 68-95, Cu 0.03, Zn 0.41, Fe 0.15, Sb 11.08, As 1.93,  $\cdot 34, = 99.89$ . S. I. T.

**Domarev (V. S.)** Домарев (В. С.). Генезис медистых песчаников Северной Родезии (по современным представлениям зарубежных геологов). [*The genesis of cupriferous sandstones of Northern Rhodesia (according to the modern ideas of foreign geologists)*]. Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1958, **87**, 55-68, 2 figs.

This is a review of recent literature on the genesis of the Copperanga-Northern Rhodesia copper belt deposits. The genetic-sedimentary theory is emphasized but many points in the full understanding of the genesis of these deposits are pointed out. It is suggested that certain recent Russian work on the facies of sedimentary rocks, and on the processes of diagenesis and metamorphism may be applied to the elucidation of the geological history of the Rhodesian deposits. [M.A. 14-110] S. I. T.

**Tholomé (P.)**. *On the paragenesis of copper ores*. Studia Univ. Lovanium Fac. Sci. Léopoldville, 1958, no. **4**, 1-32, 1 fig.

In the light of the results of experimental research as well as of factual data on the thermochemical properties of numerous natural compounds, the author proposes to analyze the facts of observation gathered in the study of minerals, especially the 'incompatibilities' and 'antipathies' manifested in mineral associations. Since in most sulphide systems the velocities of reaction are very great, the minerals found in nature are probably in equilibrium. An outline equilibrium diagram of the system Cu-Fe-S is analyzed to determine with the aid of available thermochemical data the stability fields of the various mineralogical associations as a function of the partial pressure of sulphur. The minerals concerned in these associations are pyrite, marcasite, pyrrhotite, cubanite, chalcopyrite, bornite, covellite, digenite, and chalcocite. Calculation of the free energy of formation is made for some of them. The minerals 'orange bornite' and 'sericitite' probably do not form part of the system Cu-Fe-S. The author suggests that they contain outside of this system an element which is weakly soluble at high temperature in

sulphide in which they occur as inclusions (bornite, chalcopyrite, pentlandite) and from there separate by exsolution on cooling. J. Th.

**Lacy (W. C.)**. *Porphyry copper deposit, Quajone, Peru*. Mining Engineering, A.I.M.E., New York, 1958, **10**, 104-107.

This deposit in southern Peru, near the Toquepala and Quellapeco deposits, is a mineralized breccia pipe in quartz monzonite. Pyrite is abundant. Chalcopyrite is the principal primary ore mineral, accompanied by minor bornite, galena, sphalerite, enargite, and some molybdenite. Chalcocite and covellite are formed by supergene enrichment. Chrysocolla, cuprite, tenorite and local concentrations of native copper have formed where the zone of oxidation has encroached upon enriched ore. R. G. W.

**Richard (Kenyon) & Courtright (James H.)**. *Geology of Toquepala, Peru*. Mining Engineering, A.I.M.E., New York, 1958, **10**, 262-266.

Toquepala is a porphyry copper deposit in southern Peru now being developed for open pit mining of 400 million tons of ore averaging a little over 1% Cu. The principal sulphides, hypogene pyrite and chalcopyrite, and supergene chalcocite, occur mainly as vug fillings in a large breccia pipe. Minor hypogene sulphides include bornite, molybdenite, and sphalerite. Earliest mineralization consisted of abundant tourmaline and quartz. Quartz and sericite are the principal alteration products. R. G. W.

**Kinkel (A. R., Jr.), Hall (W. E.), & Albers (J. P.)**. *Geology and base-metal deposits of west Shasta copper-zinc district, Shasta County, California*. U.S. Geol. Surv., 1956, Prof. Paper 285, 153 pp., 64 figs., 21 pls.

The Copley greenstone of probable Middle Devonian age is the oldest formation exposed in the west Shasta district and is composed of volcanic flows, breccia, and tuffs, including keratophyres and spilites. It is overlain by the Balaklala rhyolite composed of soda-rich rhyolitic tuff, and limestone. These Palaeozoic rocks are intruded by the Mule Mountain stock of albite-granite and by the Shasta Ballay biotite-quartz diorite batholith both of late Jurassic or early Cretaceous age; the Shasta Ballay batholith formed a zone of amphibolite, gneiss and migmatite at its contact with the Copley greenstone. The sulphide ore mined in the area occurs as large bodies of massive pyrite containing copper and zinc sulphides and minor

amounts of gold and silver: the ore is found through a stratigraphical thickness of 600 feet in the Balaklala rhyolite. The base-metal mineralization is probably late Jurassic or early Cretaceous in age, but no intrusive bodies can be related to the ore deposits with certainty, either spatially or genetically. Chemical analyses are given of a spilite from the Copley greenstone, extrusive and intrusive phases of the Balaklala rhyolite, and of albite-granite and quartz-diorite from the Mule Mountain stock. R. A. H.

**Nishihara (Hironao).** *Origin of the "manto" copper deposits in Lower California, Mexico.* Econ. Geol., 1957, **52**, 944-951.

It is considered that previous theories of the origin of the Mexican ore bodies of disseminated chalcocite in tuff-sandstone, which included hydrothermal solutions of magmatic origin, hot springs, supergene enrichment, and lateral secretion, lack supporting evidence. It is suggested that the copper was transported in solution from surrounding heights into the Pliocene seas and deposited with the sediments in shallow waters. R. A. H.

**Brotzen (O.).** *Kopparmineraliseringen i Norra Rhodesia och Katanga.* Geol. Fören. Förh. Stockholm, 1957, **79**, 225-248, 6 figs. (English summary.)

A review of the general geology and short descriptions of some of the ore deposits are given, and recent theories on the genesis of the ores are discussed. The ore mineralization within this region having been discussed in the literature from both syngenetic and epigenetic viewpoints, reference is made to the arguments for the two hypotheses. It is stressed that many of the characteristic features of the ores favour an epigenetic interpretation. The existence of hidden younger granites as ultimate source of the ores, however, is considered less probable than the formation and action of mantled gneiss domes. Such an interpretation introduces the processes of granitization into the discussion. It is also mentioned that, from the geochemical point of view, intrusive greenstones may be related to the ores. [M.A. 14-109] P. Lgg.

**de Wijkerslooth (P.).** *Einiges über die Entstehung von Chromitkonzentrationen und Chromerzlagertstätten an Hand von neuen Beobachtungen in Anatolien.* Neues Jahrb. Min., Montashefte, 1954, 190-200.

Chromite ore deposits in Anatolia are classified according to the chromite grain size and it is noted that the occurrence

of mono-mineralic accumulations of pyroxenes in the intrusive mass is identical with that of chromite. It is thus suggested that a study of the distribution of pyroxene masses in a basic intrusion may give an indication of the type of chromite ore to be expected. R. A. H.

**Bingham (John P.).** *Grace mine.* Mining Engineer A.I.M.E., New York, 1957, **9**, 45-48.

Near Reading, Pennsylvania, magnetite, pyrite, pyrrhotite, and some chlorite, serpentine, tremolite, and garnet replace dolomite or limestone along diabase sills. A tabular orebody, 2200 feet below the surface, was discovered as a result of an airborne magnetometer survey. R. G. W.

**Youell (R. F.).** *Mineralogical changes in weathered sedimentary ironstones.* Amer. Min., 1958, **43**, 774-777.

A stable oxidized chamosite ( $\text{Fe}^{3+}, \text{Al, Mg})_{2.9}(\text{Si, Al})_{2.1}(\text{OH})_{2.1}$  for half the orthohexagonal unit cell, has been identified as a common constituent of weathered ironstone. Chamosite, either unweathered or weathered, in sedimentary ironstones makes beneficiation of these materials difficult owing to the iron being chemically combined with silica forming silica and alumina. B. H. E.

**Hazell (J. R. T.).** *The Enugu ironstone, Udi Division, Onitsha Province [Nigeria].* Rec. Geol. Surv. Nigeria [for] 1955, 1958, 44-58, with map.

A layer of rubbly low-grade ironstone (31.9% Fe, 1.1%  $\text{P}_2\text{O}_5$ ) 2 to 28 ft. thick rests on an unconformity in Cretaceous coal measures. It consists of limonite and goethite with quartz and clay, derived from redeposited lateritic sandstones and shales. 4 analyses are given. Reserves of 60 million tons were proved, which if screened to remove sand, might yield 40 million tons averaging 40% Fe. T. D.

**Pallister (J. W.).** *Mineral resources of Somaliland Protectorate.* Overseas Geol. Min. Res. London, 1958, no. 2, 154-165.

Summarizes all previous records and the newer work of the geological survey department, established in 1949. Beryl, cassiterite, columbite-tantalite, guano, mica, and salt have been mined. Occurrences investigated include copper ores (malachite and probably tenorite), baryte, fluorite, galena (with 1.6-6.6 oz. per ton Ag), extensive gypsum-anhydrite evaporites of Eocene age, rhodonite-bearing quartz-garnet gneisses, calcareous wad deposits from



ags, pegmatites with monazite, samarskite, betafite, orthite, and sulphur and talc. Chrysotile asbestos, and spinel rocks, molybdenite, rutile, and vermiculite also recorded. Analyses of columbite, barytes, and from brine-springs are included, and there is a useful bibliography and mineral map. [M.A. 14-29] T. D.

**es (H. A.).** *The oolitic ironstones of the Agbaja Plateau, Kabba Province [Nigeria].* Rec. Geol. Surv. Nigeria [for] 1955, 1958, 20-43, 2 folding maps, 3 pls.

Ironstone occurs in Cretaceous sediments near Lokoja, averages 31 ft. in thickness with 50% Fe. It is capped by laterite and consists of oolites (6 photographs) of impure goethite, or black chalybite where unweathered. Three varieties of goethite are distinguished, minutely granular magnetite is common, and chlorites resembling chamosite and thuringite occur in both oolites and ground-mass. The ore is phosphoric ( $2\% \text{P}_2\text{O}_5$ ) and when weathered frequently contains a white powder giving the X-ray pattern of the plumbogummite group and refr. ind. near 33. Many assays and 6 chemical analyses are given. The deposit is explained as an original sedimentary chalybe-chlorite oolite which has oxidised by weathering, but one of the oolitic and pisolitic textures may have formed during weathering, as in laterites. Reserves of 30 million tons exist over 0.57 sq. miles. T. D.

**rcin (Edward J.).** *The manganese mines of Crimora, Virginia.* Rocks and Minerals, 1958, 33, 424-425, 1 fig. Although the manganese mines near Crimora, Virginia, the oldest and largest in the United States they are not present in operation. Psilomelane, pyrolusite and wad are associated with clay in a synclinal fold of Potsdam quartzite. R. S. M.

**yna (Jenaro González),** editor. *Symposium sobre yacimientos de manganeso*, 4, Asia y Oceanía. 20th Congreso Geol. Intern., México, 1956, 336 pp.

Contains papers giving details of manganese deposits and their mineralogy and mining in Asia and Oceania.

**Sondhi (V. P.).** *Manganese ores in India.* (pp. 9-23).

**Engineer (B. B.).** *Geology and economic aspects of the manganese ore deposits of Jamda-Koira Valley, Keonjhar and Bonai, Orissa, India.* (pp. 25-39).

**Roy (B. C.).** *Manganese-ore deposits of Bombay State, India.* (pp. 41-61).

**Straczek (J. A.), Subramanyam (M. R.), Narayanaswami (S.), Shukla (K. D.), Vemban (N. A.), Chakravarty (S. C.), & Venkatesh (V.).** *Manganese ore deposits of Madhya Pradesh, India.* (pp. 63-96).

**Karunakaran (C.).** *Manganese ore deposits of Mysore, India.* (pp. 97-113).

**Prasada Rao (G. H. S. V.) & Murty (Y. G. K.).** *Manganese ore deposits of Orissa and Bihar India.* (pp. 115-131).

**Mahadevan (C.) & Krishna Rao (J. S. R.).** *Genesis of manganese ores of Visakhapatnam-Srikakulam districts. (India).* (pp. 133-139).

**Straczek (J. A.) & Krishnaswamy (S.).** *Manganese ore deposits of the Vizagapatam district, Andhra, India.* (pp. 141-157).

**Bentor (Y. K.).** *The manganese occurrences at Timna' (Southern Israel), a lagoonal deposit.* (pp. 159-172).

Includes chemical analyses of manganese concretions, contact metamorphic pyrolusite rock, and of the garnet-mica-schist country rock.

**Kaneko (K.).** *Manganese deposits of Japan.* (pp. 173-197.)

**Suzuki (J.) & Ohmachi (H.).** *Manganiferous iron ore deposits in the Tokoro district of north-eastern Hokkaido, Japan.* (pp. 199-204).

**Takabatake (A.).** *Genesis of manganiferous iron deposits in Japan.* (pp. 205-220).

These ores are considered to be of submarine-exhalative type formed in geosynclinal zones. Chemical analyses are given of nine pillow lavas, an amphibolite, and a hornblende schist.

**Savage (H. E. F.).** *A note on manganese in Malaya.* (pp. 221-222).

**Muraoka (M.).** *Manganese deposits in Manchuria.* (pp. 223-235).

An analysed rhodonite ( $\text{MnO } 44.24\%$ ) from the Mu-niu-ho Mine had  $\alpha$  1.740,  $\beta$  1.742,  $\gamma$  1.752, sp. gr. 3.70.

**Master (J. M.).** *Manganese ores of Pakistan.* (pp. 237-243).

**Casey (J. N.).** *Manganese in Australia.* (pp. 247-277).

**Anon.** *Manganese in Queensland.* Mines Department of Queensland. (pp. 279-285).

**Anon.** *Manganese in New South Wales.* Mines Department of N.S.W. (pp. 287-292).

**Casey (J. N.).** *Manganese in South Australia.* (pp. 293-295).

- Stephens (E. A.).** *The manganese deposits of North Borneo.* (pp. 297–312).
- Arnould (P.) & Routhier (P.).** *Les gîtes de manganèse de Nouvelle Calédonie. Un "type" de gisement de manganèse méconnu : le type volcano sédimentaire.* (pp. 313–329).
- de la Rüe (E. Aubert).** *Le manganèse aux Nouvelles Hébrides (Mélanésie).* (pp. 331–332).
- *Sur la présence de manganèse à Rurutu (Îles Australes) établissements Français d'Océanie.* (p. 333).
- R. A. H.
- Reyna (Jenaro González),** editor. *Symposium sobre yacimientos de manganeso, 5, Europa.* 20th Congreso Geol. Intern., México, 1956, 376 pp.
- Contains details of manganese deposits and their mineralogy, paragenesis and history of mining for many territories in Europe.
- Ancion (Ch.), Calember (A.), & Macar (P.).** *Les ressources en minerais de manganèse du sous-sol de la Belgique.* (pp. 9–17).
- Pouba (Z.).** *Manganese ores in Czechoslovakia.* (pp. 19–23).
- Pastor (M.), Doestche (J.), Lizáur (J.), & de la Concha (S.).** *Criaderos de Manganeso de España.* (pp. 25–50).
- Vaasjoki (O.).** *On the natural occurrence of manganese in Finland.* (pp. 51–62).
- Lougnon (J.).** *Rapport général sur les gisements de manganèse en France.* (pp. 63–171).
- Péllissonnier (H.).** *Caractère syngénétique de manganèse des Hautes Pyrénées.* (pp. 173–195).
- Woodland (A. W.).** *The manganese deposits of Great Britain.* (pp. 197–218).
- Brief details are given of manganese workings in Devon, the English Midlands, and Scotland, together with a more extended report on the Rhiw, Caernarvonshire [M.M. 27–33, 217, 28–108, 343, 676; M.A. 8–250], and Harlech Dome, Merionethshire [M.A. 7–437] deposits. Two previously unpublished chemical analyses are given of ore from the Benallt mine, Rhiw.
- O'Brien (M. V.).** *Report for Ireland.* (pp. 219–220).
- Burckhardt (C. E.) & Falini (F.).** *Memoria sui giacimenti Italiani di manganese.* (pp. 221–272).
- Mohr (P. A.).** *A geochemical study of the Lower Cambrian manganese ore of the Harlech dome, North Wales.* (pp. 273–289).
- The source of the manganese, its mode of transportation, conditions of deposition, and the inter-relationships of these factors with palaeogeography, are discussed. Four chemical analyses of Harlech dome ores are listed together with minor element determinations for several specimens [M.M. 31–319].
- Poulsen (A. O.).** *The occurrence of manganese ores in Norway.* (pp. 291–298).
- Lechner (K.) & Plöschinger (B.).** *Die Manganerzlagstätten Österreichs.* (pp. 299–313).
- da Silva (F. J.).** *Geologie et génèse des gisements de manganèse du 'Baixo Alentejo', Portugal.* (pp. 315–347).
- A hydrothermal origin is suggested for these deposits which contain pyrolusite, psilomelane, carbonate and rhodonite. Analyses are given for the oxide, carbonate [rhodochrosite], and rhodonite.
- Ianovici (V.).** *Informations générales sur les gisements minerais de manganèse de la Roumanie.* (pp. 349–373).
- R. A. H.
- Gjelsvik (T.).** *Geochemical and mineralogical investigation of titaniferous iron ores, west coast of Norway.* *Econ. Geol.*, 1957, **52**, 482–498.
- The geological setting, mineralogical and petrographic descriptions are given for four titaniferous iron ore deposits, most of which have been subjected to regional metamorphism strong enough to obliterate primary features. Five chemical analyses of magnetite and five of ilmenite are given. Cr, Ni, Co, Cu, V, and Mn have been determined in twenty rock and mineral samples. Cr is strongly concentrated in magnetite; Mn in ilmenite; Ni and V are distributed between magnetite and ilmenite in a ratio close to 4:1; Co and Cu show no particular enrichment in the oxide minerals.
- G. D. N.
- Ljunggren (P.).** *Origin of the manganese ore deposit at Bölet, southern Sweden.* *Fysiograf. Sällsk. Förh. Lund* 1958, **28**, 95–107, 2 figs.
- At Bölet in the parish of Uddenäs in southern Sweden manganese mineralization has taken place, localized to the brecciated zones in the granitic bedrock. Most of the manganese ores of Bölet consist of almost pure manganite but a partial replacement of manganite by pyrolusite is not



ual. The ore also contains calcite, barite, fluorite in small portions some other minerals, e.g. vanadinite rhodochrosite. It is difficult to state anything definite at the origin of the manganese deposit of Bölet, as later alterations may have obscured the original features of the Quadrivalent manganese oxides, perhaps of the psilone type, are considered to have constituted the primary manganese compounds.

E. Å-n.

ae (M.). *Celestine from the Udô mine, Shimané Prefecture.* Journ. Min. Soc. Japan, 1957, **3**, 165-166 (in Japanese).

brous, translucent, pale blue celestine found in the thermal gypsum deposit of the Udô mine has H. 3.5, gr. 3-961. It is reported to be spectroscopically pure

R. A. H.

glas (G. Vibert) & Goodman (Nordau R.). *The deposition of gypsum and anhydrite.* Econ. Geol., 1957, **52**, 831-837.

ne effects of temperature and pressure after deposition, of heat through the bottom of the lagoon, and addition of fresh water with or without accompanying silt from the areas around the lagoon are considered and their influence on the origin of deposits which contain both gypsum and anhydrite are discussed.

R. A. H.

oy (Donald B.) & Lamar (J. E.). *Gypsum and anhydrite in Illinois.* Illinois State Geol. Surv., 1957, circ. **226**, 26 pp., 7 figs.

gypsum and anhydrite occur in the St. Louis limestone, anhydrite prevailing in the deeper parts of the structural basin and both gypsum and anhydrite occurring in the shallower marginal area. Analyses A and B are of gypsum, C and D of anhydrite from a diamond drill core in Mangamon County; anhydrite E is from a drill core in Madison County: analyses by L. D. McVicker.

SiO <sub>2</sub> + insol.	Fe <sub>2</sub> O <sub>3</sub> + Al <sub>2</sub> O <sub>3</sub>	MgO	CaO	NaCl	CO <sub>2</sub>	SO <sub>3</sub>	H <sub>2</sub> O +	H <sub>2</sub> O -	Total
1.46	0.16	1.14	33.64	0.34	2.04	45.88	16.04	0.01	100.71
0.68	0.18	0.28	32.76	0.69	0.28	45.88	20.23	0.01	100.99
0.50	0.10	0.60	40.86	0.38	0.37	57.10	0.69	0.01	100.61
1.14	0.16	1.86	40.26	0.15	3.93	52.50	0.46	0.01	100.47
0.50	0.04	0.18	41.06	0.26	1.04	56.34	1.23	0.01	100.66

R. A. H.

ell (R. H.). *Anhydrite complex of the Morococha district, Peru.* Econ. Geol., 1957, **52**, 632-644, 9 figs.

Jurassic limestones in the Morococha copper-silver-lead-zinc mining district, central Peru, were intruded by Tertiary quartz monzonite stocks and have been altered to diopside-tremolite, serpentine-chlorite-talc, and anhydrite assemblages. Hydrothermal replacement of the limestone, following the intrusion of the monzonite stocks and prior to ore deposition, is considered to be the most probable sequence of events. After emplacement of the ore bodies descending meteoric waters converted the upper part of the anhydrite complex to gypsum.

R. A. H.

Kulstad (Robert O.), Fairchild (Paul), & McGregor (Duncan).

*Gypsum in Kansas.* Bull. Kansas Geol. Survey, 1956, **113**, 1-110, 20 pls., 15 figs.

The paper describes the petrology and occurrence of commercial gypsum deposits in the (Permian) Blaine, Wellington, and Easley Creek formations. The Blaine gypsum includes lenses of anhydrite. Both gypsum and anhydrite are thought to have been formed by original deposition from sea water, although some of the anhydrite has subsequently been hydrated to gypsum. Wellington gypsum probably was formed by hydration of anhydrite by action of ground water. Easley Creek gypsum was deposited as gypsum.

A. Sw.

Grossman (Irving G.). *The sodium sulphate deposits of Western North Dakota.* North Dakota Geol. Survey Rep. Investigations, 1949, no. **1**, 66 pp.

A general report describing the occurrences of sodium sulphate. Mirabilite and thenardite are known to occur; other minerals may be present, but detailed mineralogical study has only begun.

R. A. Hp.

Faust (G. T.) & Callaghan (Eugene). *Mineralogy and petrology of the Currant Creek magnesite deposits and associated rocks of Nevada: new data.* Bull. Geol. Soc. America, 1958, **69**, 353-354.

In a previous paper (Ibid. 1948, **59**, 11-74) the authors referred to a "dolomite-magnesite solid-solution series" which has since been shown to be a new mineral, huntite [A.M. **38-4**]. Corrections and additions to the previous paper are given. [M.M. **30-734**; M.A. **12-132**] A. L. A.

Morris (R. C.) & Dickey (P. A.). *Modern evaporite deposition in Peru.* Bull. Amer. Assoc. Petrol. Geol., 1957, **41**, 2467-2474.

Gypsum is being precipitated near the head and halite at the extreme end of the Bocana de Virrila, near Bayovar, Peru. Black muds occur on the bottom of this marine estuary. A high evaporation rate of the waters causes increases in the concentration of various salts found in normal sea water and a horizontal salinity gradient has been established with total salt concentrations rising to more than 350,000 parts per million at the head of the estuary.

G. D. N.

**Hanahan (John).** *Pyrophyllite in Central North Carolina.*

*Rocks and Minerals*, 1958, **33**, 312-314, 2 figs.

Pyrophyllite occurs in lenses within bodies of acid volcanic tuff of pre-Cambrian or Ordovician age in and around Randolph, Moore, Chatham, Alamance, and Montgomery Counties, North Carolina. The pyrophyllite occurs as white to green dense foliated masses. Single crystals with terminations are occasionally observed in small vugs. Associated minerals include lazulite, quartz crystals, pyrite crystals (up to 3 in. by 3 in.), rutile, sphene, sericite, chloritoid, epidote, zircon, apatite, and zeolites. R. S. M.

**Henriques (Åke).** *Swedish pyrophyllite deposits and the optical properties of pyrophyllite.* *Arkiv Min. Geol.*, 1957, **2**, 279-282.

Pyrophyllite occurs in vugs and fissures in a primary

sedimentary iron ore interbedded in pre-Cambrian kyanite-bearing quartzites in the Västana area, Näsund parish, Kristianstad county, Sweden. It is found as silver-white crystal bundles, {001} cleavage,  $\alpha$  1.556,  $\beta$  1.589,  $\gamma$  1.602,  $2V_a$  62°,  $\alpha : a$  88½°.  $\gamma = b$ , O.A.P. (010) [inconsistent with other data]: a chemical analysis by A. Aaremäe gives SiO<sub>2</sub> 64.88, TiO<sub>2</sub> 0.02, Al<sub>2</sub>O<sub>3</sub> 28.64, Fe<sub>2</sub>O<sub>3</sub> 0.48, MnO 0.03, CaO 0.03, MgO 0.08, Na<sub>2</sub>O 0.03, K<sub>2</sub>O 0.04, H<sub>2</sub>O+ 5.7, H<sub>2</sub>O- 0.09, =99.78. Other Swedish occurrences of pyrophyllite are briefly described. [M.A. **7-310**, **11-249**, **13-44**]

R. A. H.

**Stuckey (Jasper L.).** *Resources and utilization of North Carolina pyrophyllite.* Mining Engineering, A.I.M.E., New York, 1958, **10**, no. 1, 97-99.

The 15 known pyrophyllite deposits of North Carolina occur in metamorphosed acidic tuffs and breccias of the Piedmont region. The pyrophyllite occurs as foliated masses, massive granular bodies, and radial fibrous aggregates. Quartz is abundant. Sericite is concentrated along the hanging wall and to a lesser extent along the footwall. Diaspore, topaz, andalusite, and kyanite are in minor deposits. Chloritoid may be abundant. Chlorite, pyrite, hematite, and magnetite are common but minor accessories. Pyrophyllite was formed by metasomatic replacement of silicified tuffs and breccias.

R. G. W.

## EXPERIMENTAL MINERALOGY

**[Khitarov (N. I.)** Хитаров (Н. И.). Вопросы петрогенеза в свете экспериментальных данных. [*Problems of petrogenesis on experimental data*]. Геохимия, Изд. Акад. Наук СССР [Geochemistry, Publ. Acad. Sci. U.S.S.R.], 1958, no. **6**, 524-534, 2 figs.

Observation of volcanic activity and experiments in an autoclave suggest that volatiles rich in water tend to accumulate at the head of a magmatic chamber forming an upper zone which, through convection currents, tends to acquire a higher temperature than the body of the magma. Experimental heating of a mixture of powdered igneous rocks and water under high pressure and temperature has shown that the water soluble extract from basalt, in composition in terms of SiO<sub>2</sub> and Al<sub>2</sub>O<sub>3</sub> and alkalis, tends towards that of nepheline syenite at the lower pressures and temperatures, and at higher towards quartz keratophyre. The composition of the extract from powdered

granite also shows an increase in silica. The bearings of these experiments on the problems of petrogenesis are discussed.

S. I. T.

**[Khitarov (N. I.)** Хитаров (Н. И.). Об условиях плавления гранитного субстрата [*On the conditions of fusion of the granite substratum*]. Геохимия, Изд. Акад. Наук СССР [Geochemistry, Publ. Acad. Sci. U.S.S.R.], 1958, no. **2**, 102-108, 3 figs.

The work of Bowen and Tuttle on the synthesis and melting of granite is discussed; then follows description of further experiments on the fusion of granite in the presence of fluxes corresponding in composition to the materials contained in the gaseous and liquid inclusions in natural minerals of the granitic rocks. The main conclusion is that with a geothermal gradient of 30°/km the beginning of the fusion of the granite substratum will take place at



at a depth of 21 km, and with a gradient of  $50^{\circ}/\text{km}$   $60^{\circ}\text{C}$  at 13 km. With the gradient of  $30^{\circ}/\text{km}$  in the presence of 9%  $\text{H}_2\text{O}$  fusion will begin and be completed at both of 21 km, while in the presence of 2%  $\text{H}_2\text{O}$  it will melt at 21 km and be completed at 31 km. S. I. T.

**Хитаров (Н. И.), Арсеньева (Р. В.), & Лебедев (Е. Б.)** [Хитаров (Н. И.), Арсеньева (Р. В.) и Лебедев (Е. Б.). Опыты по оплавлению гранита в присутствии воды [Experiments dealing with the fusion of granite in the presence of water]. Геохимия, Изд. Акад. Наук СССР [Geochemistry, Publ. Acad. Sci. U.S.S.R.], 1957, no. 5, 380–384, 4 figs.

A specially constructed apparatus is described for the experimental fusion of crushed granite in the presence of water at temperatures between  $700\text{--}900^{\circ}\text{C}$  and pressures of 1000–4000 atmospheres. The effects of high temperature on potash-feldspar, plagioclase, quartz, biotite, and chlorite composing the sample of granite are recorded and it is concluded that this particular granite, in the presence of water, will fully melt at  $700^{\circ}\text{C}$  and 4000 atmospheres pressure. The formation of an early glass enriched in silica suggests that under natural conditions this alkaline feldspar may migrate into the surrounding rocks. S. I. T.

**Питерс (Peter K.).** *The solution kinetics of calcite.* Journ. Geol., 66, 163–176.

An experiment and mathematical analysis of solution rates of calcite show that solution alteration in limestone depends on the rate at which water entering the rock becomes saturated. Calculations indicate that for laminar flow in a light circular capillary of radius 'a' the solution will be 50% saturated after penetrating a distance of  $0.572 \sqrt{va^2/D}$  where 'v' is the average flow velocity of the fluid and 'D' is the diffusion constant of the solute in the solution. H. L.

**Аарссон (G.).** *Kristallisationserscheinungen und Paragenese in den Systemen der Alkalichloride-Erdalkalichloride-Wasser.* Sveriges Geol. Unders., 1957, Ser. C, 556, 1–17, 6 figs. (English summary.)

The author reviews earlier investigations of aqueous multicomponent systems of alkali and alkali-earth chlorides. Chemical, physical, and crystallographic data are given for the most important phases involved. The system  $\text{KCl--CaCl}_2\text{--H}_2\text{O}$  is thoroughly discussed for temperatures

between  $15^{\circ}$  and  $100^{\circ}\text{C}$  and a new equilibrium diagram is given. The possibilities of using the results for industrial separation of different phases are discussed. The paragenetic alternatives in the polycomponent systems in question are elucidated by a table and related to salt deposits. It is pointed out that some phases which have so far not been discovered as natural minerals might occur in certain cases, e.g.  $\text{SrCl}_2 \cdot 2\text{H}_2\text{O}$  and  $\text{BaCl}_2 \cdot \text{H}_2\text{O}$ . K. F.

**Harada (Z.) & Goto (M.).** *On an experimental condition favourable for the formation of aragonite.* Journ. Min. Soc. Japan, 1957, 3, 137–145 (in Japanese).

Crystalline  $\text{CaCO}_3$  was synthesized by the diffusion method in aqueous solutions of methanol, ethanol, glycol, or glycerine, so that  $\text{Ca}^{2+}$  and  $\text{CO}_3^{2-}$  reacted slowly. The rate of formation of aragonite was found to vary with the dielectric constant of the solution, a low value being more favourable for its formation. R. A. H.

**Harker (R. I.).** *The system  $\text{MgO--CO}_2\text{--A}$ , and the effect of inert [gas] pressure on certain types of hydrothermal reaction.* Amer. Journ. Sci., 1958, 256, 128–138.

Thermal data for the dissociation of magnesite at several pressures of  $\text{CO}_2$  plus inert gas ( $\text{He}$ ,  $\text{N}_2$ , or  $\text{A}$ ) show that the equilibrium temperature for this reaction is largely dependent upon the proportion of  $\text{CO}_2$  at a given total pressure. Consequently, in a terrane that shows generally minerals of a single metamorphic grade, higher-grade minerals may be stable in metamorphosed carbonate + hydrate rocks than in correlative carbonates or hydrates. H. W.

**Roy (Della M.) & Roy (Rustum).** *A re-determination of equilibrium in the system  $\text{MgO--H}_2\text{O}$  and comments on earlier work.* Amer. Journ. Sci., 1957, 255, 574–583, 2 figs.

A new determination of the  $P\text{--}T$  curve for the reaction  $\text{Mg}(\text{OH})_2 \rightleftharpoons \text{MgO} + \text{H}_2\text{O}$  has been made, particular attention being paid to the quenching of the charges from elevated temperature and pressure. The technique of suddenly dropping the pressure and then the temperature was adopted and in the case of brucite it was essential that the drop in temperature should follow as soon as possible after the drop in pressure to prevent dehydration of the brucite. It is stressed that although  $\text{MgO}$  may be prepared in forms having greater heat content than normal, such forms must be regarded as metastable and should not be considered

in discussions of stable equilibrium and are unlikely to be encountered under natural geological conditions. [M.A. 13-176, 271]

W. S. M.

**Fyfe (W. S.).** *A further attempt to determine the vapor pressure of brucite.* Amer. Journ. Sci., 1958, **256**, 729-732.

The equilibrium vapor pressure of brucite should determine the pressure-volume curves at constant temperature. Data presented agree with those of Kennedy [M.A. 13-176] but disagree with those of Roy and Roy [previous abstract]. Measured equilibrium vapor pressures must lie between 200 and 300 bars at 530°C, 490 and 570 bars at 570°C; curves based on these and further data are given, the lower and upper limits being due to observations during dehydration and hydration, respectively.

H. W.

**Peretti (E. A.).** *Thermal decomposition of lead carbonate.* Journ. Amer. Ceram. Soc., 1957, **40**, 171-173, 1 pl., 2 figs.

The decomposition temperatures at 1 atm. CO<sub>2</sub> pressure for PbCO<sub>3</sub>.PbO.PbCO<sub>3</sub> and 2PbO.PbCO<sub>3</sub> are 263°, 389° and 438°C respectively. X-ray diffraction data for PbO.PbCO<sub>3</sub> are given.

P. K. H.

**Morey (George W.).** *The system water-nepheline-albite: a theoretical discussion.* Amer. Journ. Sci., 1957, **255**, 461-480, 11 figs.

The phases considered are a gas, a liquid, analcite, jadeite, nepheline, and albite. There are six possible quintuple points and the sequence of the *PT* curves around these points is deduced and possible phase relations considered.

W. S. M.

**Kalousek (George L.).** *Crystal chemistry of hydrous calcium silicates: I, substitution of aluminum in lattice of tobermorite.* Journ. Amer. Ceram. Soc., 1957, **40**, 74-80, 1 pl., 4 figs.

Mixtures of kaolin, microcrystalline quartz and quicklime and water are heated to 170-175°C. X-ray diffraction and d.t.a. identify the product as tobermorite. [M.M. 29-960]. Over 5% Al<sub>2</sub>O<sub>3</sub> in the mixture results in increased Al<sub>2</sub>O<sub>3</sub> substitution in tobermorite as well as the second phase, hydrogarnet. Al<sup>3+</sup> ions probably assume tetrahedral coordination when substituting for Si<sup>4+</sup>.

P. K. H.

**Kalousek (George L.) & Roy (Rustum).** *Crystal chemistry of hydrous calcium silicates: II, Characterization of interlayer water.* Journ. Amer. Ceram. Soc., 1957, 236-239, 2 figs.

Although tobermorite and xonotlite show the same infrared absorption in the 8 to 15μ region, tobermorite exhibits strong absorption at 6.2μ, a band usually associated with interlayer water, and at 2.9μ, a band generally attributed to bonded (OH). Xonotlite does not show these two bands but contains one at 2.75μ which is usually associated with free (OH). Contains infrared absorption spectra and X-ray diffractometer tracings.

P. K. H.

**Barrer (R. M.) & Langley (D. A.).** *Reactions and stability of chabazite-like phases. Part I. Ion-exchanged forms of natural chabazite.* Journ. Chem. Soc., 1958, 380-381, 9 figs.

The effects of heat on cation-exchanged forms of chabazite have been investigated by d.t.a., thermogravimetry and X-ray methods. A rather siliceous natural chabazite with a Si:Al ratio a little greater than 5, from the Bay of Fundy, Nova Scotia, was used, eleven cation-exchanged forms being prepared and investigated between 20° and about 1100°C. The influence of the cation on thermal stability was in the order Li < Na < K < Rb < Cs, and water retentivity in the order Li > Na > K > Rb. Decomposition of the parent lattice yielded in addition to glass occasional quartz, β-eucryptite, leucite, and H-chabazite. [M.A. 13-115]

——— *Part II. Ion-exchanged forms of some synthetic species.* Journ. Chem. Soc., 1958, 3811-3816, 7 figs.

——— *Part III. Intracrystalline water.* Ibid., 3817-3824, 4 figs.

When minerals produced from the cation-exchanged forms were based on aluminosilicate frameworks of different type from chabazite, mineral growth was normally preceded by a structural breakdown to a glassy phase: in other species the chabazite lattice changed directly into the lattice of the new species. Products include quartz, eucryptite, leucite, nosean, nepheline, hauyne, kaliophyllite and α-carnegieite. [M.A. 13-449]

R. A. H.

**Kiriyama (R.), Koizumi (M.), Yamada (K.), & Kitagawa (R.).** *Hydrothermal reaction of zeolites.* Journ. Mineralogical Soc. Japan, 1957, **3**, 107-123 (in Japanese).



powder obtained by heating natrolite at 700°C was heated with distilled water at between 150° and 300°C for 6 to 144 hours. At 200°C the natrolite lattice is to some extent reconstructed after 48 hours, but later after 96 hours breaks down, and finally after 96 hours rather perfect lattices of natrolite and analcite are found. At 225°C, however, only analcite is readily formed. The higher the water content in the reaction vessel and the greater the amount of Na<sup>+</sup> dissolved into the aqueous solution the less perfect is the lattice of the resultant. In some media both analcite and natrolite are stable but in other media only natrolite was obtained as the product of the reaction.

R. A. H.

**He (I. R.) & Davies (D. R.).** *The inter-diffusion of two charged particles (with particular reference to ion-exchange in zeolites).* Phil. Mag., 1957, ser. 8, **2**, 599–606.

An equation is formulated relating the quantity of material exchanged during an ion exchange reaction with individual diffusion coefficients of the two migrating ions and with the square root of the duration of the experiment.

R. A. H.

**Her (R. M.) & Falconer (J. D.).** *Ion exchange in feldspatoids as a solid-state reaction.* Proc. Roy. Soc., 1956, **236A**, 227–249, 10 figs.

A quantitative investigation has been made of ion-exchange diffusion and equilibria in the synthetic materials cancrinite ( $M_2O \cdot Al_2O_3 \cdot 2.4SiO_2 \cdot 0.6MOH \cdot xH_2O$ ), basic leucite ( $M_2O \cdot Al_2O_3 \cdot 2.5SiO_2 \cdot 0.34MOH \cdot xH_2O$ ), and K and Na-leucite [leucite?] ( $M_2O \cdot Al_2O_3 \cdot 4SiO_2$ ). A model which regards the reactions as an interchange of ions between two dielectrics is considered to provide a simple explanation of the observed behaviour.

R. A. H.

**Imdar (A. J.) & Roy (Rustum).** *Fugacities and free energies of CO<sub>2</sub> at high pressures and temperatures.* Geochim. Cosmochim. Acta, 1956, **11**, 311–315, 1 fig. Data are given for temperatures between 50 and 1000°C and pressures between 25 and 1400 bars.

J. R. B.

**Im (L. B.), Roy (Rustum), & Osborn (E. F.).** *Stability relations of some minerals in the Na<sub>2</sub>O–Al<sub>2</sub>O<sub>3</sub>–SiO<sub>2</sub>–H<sub>2</sub>O system.* Econ. Geol., 1957, **52**, 169–179 and 464, 6 figs.

Results of phase equilibrium studies in this system are restricted to compositions of geological interest, i.e. com-

positions of low Na<sub>2</sub>O content. Phase diagrams show the stable assemblages over the temperature range 250°–700°C and apply to a water pressure of 15,000 lb/in<sup>2</sup>. Additional experiments at various pressures show that pressure has only a slight effect on the temperature of the reactions investigated. Paragonite and soda montmorillonite co-exist between 250° and 400°C. Nepheline is unstable below 460°C, its place being taken by nepheline hydrate. In the temperature range 480°–525°C the join paragonite–nepheline cuts off analcite from stable co-existence with corundum. Paragonite decomposes at 625°C. W. S. M.

**DeVries (R. C.) & Osborn (E. F.).** *Phase equilibria in high-alumina part of the system CaO–MgO–Al<sub>2</sub>O<sub>3</sub>–SiO<sub>2</sub>.* Journ. Amer. Ceram. Soc., 1957, **40**, 6–15, 11 figs.

An investigation of the phase equilibria among crystalline and liquid phases of the system CaO–MgO–Al<sub>2</sub>O<sub>3</sub>–SiO<sub>2</sub>, at Al<sub>2</sub>O<sub>3</sub> contents over 35%, using the static method with subsequent quenching. Five triangular joins are given. The composition and nature of the 4 quaternary peritectic points and the relationships of univariant lines and primary phase volumes are discussed.

P. K. H.

**McQuarrie (Malcolm).** *Studies in the system (Ba,Ca,Pb)TiO<sub>3</sub>* Journ. Amer. Ceram. Soc., 1957, **40**, 35–41, 8 figs.

The weight loss, dye adsorption, crystalline phase or phases, dielectric constant, dissipation factor, and temperature variation of dielectric constant are determined for various bodies in the system (Ba,Ca,Pb)TiO<sub>3</sub> fired in air between 800° to 1400°C. The electrical properties correlate well with the crystalline constitution. The two-phase region of the barium-calcium titanite binary extends into the ternary to about 35 mole % lead titanite. P. K. H.

**Sahores (Jean).** *Caractères thermiques des phosphates de la famille de la vivianite.* C.R. Acad. Sci. Paris, 1955, **241**, 221–223.

D.t.a. can distinguish between the phosphates of nickel, of cobalt, and of magnesium or iron but not between the last two. Phosphate of nickel after dehydration recrystallizes at a temperature higher than that of the arsenate; the other phosphates of this series recrystallize at lower temperatures than their arsenical homologues.

E. J. & A. S.

**Anon.** *Crystal chemistry of tooth and bone material.* Journ. Washington Acad. Sci., 1957, **47**, no. 6, 202–204.

At the National Bureau of Standards crystals of pure hydroxy-apatite ( $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ ) up to 0.3 mm. in length were synthesized hydrothermally by the hydrolysis of monetite ( $\text{CaHPO}_4$ ) at 300°C and 1250 lb/in<sup>2</sup> saturated steam pressure. By varying the pH at which apatite was precipitated 'defect' hydroxyapatites were prepared with atomic ratios of Ca : P between 10 : 6 and 8.2 : 6, the latter value being close to that commonly found for calcified tissue (bone, teeth, etc.).

F. A. M.

**Carl (James D.) & Amstutz (G. C.).** *Three-dimensional Liesegang rings by diffusion in a colloidal matrix, and their significance for the interpretation of geological phenomena.* Bull. Geol. Soc. America, 1958, **69**, 1467-1468, 2 pls.

Three-dimensional Liesegang rings were produced by reaction between potassium dichromate and silver nitrate in a rocklike mass consisting of 80-90% quartz grains and 5-10% gelatin. It is suggested that Liesegang diffusion phenomena offer an explanation for weathering rings and multiple exfoliation.

A. L. A.

**Machin (J. S.) & Hanna (D. L.).** *Viscosity studies of system  $\text{CaO-MgO-Al}_2\text{O}_3\text{-SiO}_2$ : I, 40%  $\text{SiO}_2$ .* Journ. Amer. Ceram. Soc., 1945, **28**, 310-316. W. A. Wh.

**Machin (J. S.) & Yee (Tin Boo).** *Viscosity studies of system  $\text{CaO-MgO-Al}_2\text{O}_3\text{-SiO}_2$ : II,  $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2$ .* Journ. Amer. Ceram. Soc., 1948, **31**, 200-204.

Viscosity data are presented covering those compositions in the  $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2$  system which are liquid at 1500°C. The pattern of isokoms on the  $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2$  face of the compositional tetrahedron which represents the  $\text{CaO-MgO-Al}_2\text{O}_3\text{-SiO}_2$  system is a system of lines which roughly parallel the lines along which lime content is constant.

There are, however, considerable deviations from parallelism in regions of very low and very high alumina content.

W. A. Wh.

**Machin (J. S.), Yee (T. B.), & Hanna (D. L.).** *Viscosity studies of system  $\text{CaO-MgO-Al}_2\text{O}_3\text{-SiO}_2$ : III, 35, 45% and 50%  $\text{SiO}_2$ .* Journ. Amer. Ceram. Soc., 1948, **35**, 322-325.

This is a continuation of previous papers on the viscosity in the system  $\text{CaO-MgO-Al}_2\text{O}_3\text{-SiO}_2$ . Data are presented for melts containing 35%, 45%, and 50%  $\text{SiO}_2$  with varying percentages of the other three oxides which make up the system.

W. A. Wh.

**Machin (J. S.) & Yee (T. B.).** *Viscosity studies of system  $\text{CaO-MgO-Al}_2\text{O}_3\text{-SiO}_2$ : IV, 60 and 65%  $\text{SiO}_2$ .* Journ. Amer. Ceram. Soc., 1954, **37**, 177-186. W. A. Wh.

**Bontinck (W.) & Amelinckx (S.).** *Observation of helical dislocation lines in fluorite crystals.* Phil. Mag., 1953, ser. 8, **2**, 94-96, 2 figs., 1 pl.

**Amelinckx (S.), Bontinck (W.), Dekeyser (W.), & Seitz (W.).** *On the formation and properties of helical dislocations in fluorite.* Ibid., 1954, **3**, 355-378, 12 figs., 1 pl.

**Bontinck (W.).** *Climb phenomena in synthetic fluorite crystals.* Ibid., 1954, **3**, 561-567, 7 figs., 3 pls.

**Amelinckx (S.), Bontinck (W.), & Dekeyser (W.).** *Helical dislocations and spiral etch-pits.* Ibid., 1954, **3**, 1264-1268, 4 figs., 1 pl.

By heating synthetic fluorite crystals at 1200°C in a hydrogen atmosphere, after they had been coated with a thin layer of silver evaporated in a high vacuum, decorated helical dislocations are seen. The properties of these helical dislocations and the model of F-centres in fluorite and their equilibrium characteristics are discussed. [M.A. **13**-197]

R. A. H.

## GEMSTONES

**Bragg (Sir Lawrence).** *Gemstones.* Proc. Roy. Institution, 1958, **37**, 1-15.

In a review of the physical properties which make minerals suitable for gemstones diamond, beryl, topaz, spinel, garnet, tourmaline, olivine, zircon and chrysoberyl are mentioned. The red coloration in ruby is caused by the

chromium ion replacing the smaller aluminium ion and the iron ion being under considerable pressure, this pressure being great that it transfers the absorbed light into the red region of the spectrum: this also applies to Mg-Al spinel, pyrope garnet, in both of which the red colour is due to the trace of chromium replacing aluminium. In the more or



structure the true green chromium coloration is seen in emerald, although in aquamarine the colour is due to

R. A. H.

**an (B. S.).** *A study of style and fashion in Indian jewelry.* Gems and Gemology, 1958, **9**, 204–220.

J. A. H.

**(J. E.).** *The lapidary of the Learned King.* Gems and Gemology, 1958, **9**, 105–110 and 118–121.

Description of Alfonso X el Sabio's book the "Lapidary". This little known work on gems, transcribed about 1280 A.D., is located in the Escorial, Madrid. Some 360 stones and gems are dealt with under Spanish, Latin, and Arabic names, and not all can be identified today. The physical and medicinal qualities of some are given. Four plates of illuminations are reproduced which are of a type usually seen only in books of 'hours'. A modern index and vocabulary are in preparation. J. A. H.

**(R.).** *The constituents and nature of matter.* Gems and Gemology, 1958, **9**, 148–157.

The first of a series of articles on the structure of matter and the nature of crystals. J. A. H.

**(R.).** *The nature of crystals—geometric relationships.* Gems and Gemology, 1958, **9**, 180–190.

The continuation of an article in the previous issue by the same author on the structure of matter and the nature of crystals. J. A. H.

**onahay (W. C.).** *Clarity.* Gems and Gemology, 1958, **9**, 174–179 and 190.

An intelligent plea for the elimination of 'negative' terminology in the description of gem materials. J. A. H.

**lin (E. J.).** *Emeralds from Sandawana.* Journ. Gemology, 1958, **6**, 340–354, 7 photos, 1 pl. (coloured). Emeralds of gem quality were found by Contat and van Huizen associated with granitic pegmatites cutting Cambrian (Bulawayan) tremolite schists and altered dolomites at Sandawana (29° 56' E., 20° 55' S.), south of Mweza Range, Southern Rhodesia. They are remarkable for their superb verdant emerald colour and high transparency: their characteristic minor inclusions, mainly fine tremolite needles, are described to allow these

emeralds to be distinguished from those of other localities. A chemical analysis (mainly on 50 mg) by M. Weibel gave  $\text{SiO}_2$  65,  $\text{Al}_2\text{O}_3$  14.2,  $\text{BeO}$  13.6,  $\text{Cr}_2\text{O}_3$  0.5,  $\text{Fe}_2\text{O}_3$  0.5,  $\text{MgO}$  3.0,  $\text{Na}_2\text{O}$  2.0,  $\text{Li}_2\text{O}$  0.15, = 99.0. Optical data include  $n = 1.586$ ,  $\omega = 1.593$ , birefringence 0.007, dispersion (B–F) 0.009: data for emeralds from other localities are tabulated.

R. A. H.

**Gübelin (E. J.).** *Notes on the new emeralds from Sandawana.* Gems and Gemology, 1958, **9**, 195–203.

The story of the discovery of emeralds in the Belingwe area in Southern Rhodesia is briefly told and physical and optical properties are given. Constants ( $\omega = 1.593$ ,  $n = 1.586$ ; sp. gr. 2.744–2.768) were found to be close to those of Indian and Habachtal emeralds and inclusions of tremolite needles are such that the author feels they can be used to distinguish the Sandawana. Seven photomicrographs are used to illustrate the typical inclusions. The stones found to date have been small but of exceptionally fine colour. [See previous abstract] J. A. H.

**Mayers (D. E.).** *Sandawana emeralds—Some commercial aspects.* Gems and Gemology, 1958, **9**, 221–223.

Marketing plans for the Sandawana emeralds are outlined. J. A. H.

**Eppler (W. F.).** *Synthetic emerald.* Journ. Gemology, 1958, **6**, 360–369, 16 photos.

A shortened version of a series of articles, *Synthetischer Smaragd*, in Deutsche Goldschmelde-Zeitung in which the three methods of producing synthetic emeralds are reviewed. These are the method used by Nacken from around 1928 [M.A. 10–104] which is believed to have been a hydrothermal one, the I.G. Farbenindustrie diffusion melt method which produced synthetic crystals named igmerald [M.A. 6–200, 497] and the method of C. F. Chatham, of San Francisco [M.A. 3–269, 270, 9–51], which produces the only synthetic emerald marketed regularly at present. Both Igmerald and the Chatham synthetic stones show inclusions of phenacite due to a local deficiency of  $\text{Al}_2\text{O}_3$  in the melt. Although small specific differences exist in the inclusions of the synthetic emeralds the veil-like liquid inclusions are basically so similar in the Igmerald and Chatham material that it seems evident that similar methods of production were used. A group of Chatham's synthetic emerald crystals shows evidence of having grown downwards from pieces of quartz floating in the molten mass.

R. A. H.

**Sterrett (Douglas B.).** "Old Plantation" Emerald Mine. Rocks and Minerals, 1958, **33**, 302-307, 6 figs.

A historical account of the discovery of emerald localities in North Carolina, with special emphasis on the Turner or "Old Plantation" mine in Cleveland County. The "Old Plantation" emeralds, frequently striated and etched, occur in a pegmatite associated with quartz (some smoky), feldspar (some albite), black tourmaline, and beryl. Total output of emeralds before the mine was closed was about 3000 carats.

R. S. M.

**Zwaan (P. C.).** Remarks on inclusions in an aquamarine. Proc. Koninkl. Nederlandse Akad. Wetensch., 1958, ser. B, **61**, no. 4, 260-264, 3 figs.

In a cut aquamarine of unknown origin with  $\omega$  (yellowish) 1.578,  $\epsilon$  (bluish) 1.572, sp. gr. 2.693, a plane containing negative crystals, tubular, and irregular inclusions is oriented  $\parallel c$ . Planes are also observed  $\parallel (0001)$  which contain irregular droplike forms. Recrystallization of beryl will have taken place in these drops. The genealogy of all inclusions is discussed. The negative crystals have two liquid phases and a vapour phase; one of the liquid phases heated to about 30°C disappears and is believed to be liquid  $\text{CO}_2$ . C. J. O.

**Gübelin (E. J.).** A contribution to the genealogy of inclusions. Journ. Gemmology, 1957, **6**, 1-47, 60 figs.

The formation of autogenetic and xenogenetic inclusions, healing fissures (secondary liquid inclusions) and inclusions formed by exsolution is discussed. A new classification for gemstone inclusions distinguishes between primary and secondary types. Most secondary inclusions are healing fissures which are either completely or partly healed cracks, or were still in a state of healing when the gem was extracted from the earth. Solid secondary inclusions are frequently formed by the process of exsolution. G. F. A.

**Payne (C. J.).** A crystal of sinhalite from Mogok, Burma. Min. Mag., 1958, **31**, 978-979, 1 fig.

The first well-developed crystal of sinhalite [M.M. 29-841; M.A. 13-368] is recorded and is an orthorhombic prismatic crystal of 0.68 gramme, sp. gr. 3.49. Forms present are {010}, {001}, {100}, {110}, {120}, {130}, {111}, {112}, {132}, {101}, and {021}: the calculated and measured interfacial angles are listed. Optical properties include O.A.P. (001), acute bisectrix  $b$ ;  $2V$  about 55°; pleochroism  $\alpha$  brown,  $\beta$  pale brown,  $\gamma$  pale greenish brown, with  $\alpha > \beta > \gamma$ .

R. A. H.

**Walton (J.).** The formation of quartz and chalcedony. Gemmologist, 1955, **24**, 119-123, 139-142, 164-191-194.

The formation of pegmatites and the order in which minerals crystallize out in them are discussed. The occurrence of the various varieties of quartz is considered in detail. It is suggested that the term chalcedony, which is used for the cryptocrystalline quartz group, should be reserved for the variety, and the group designated as cryptocrystalline quartz. The formations and varieties produced are mentioned.

G. F. A.

**Martin (J. G. M.).** Historical Himalaya tourmaline production resumes production. Gems and Gemology, 1958, **163-173**.

The story of the re-opening, after some 44 years, of the most productive of the gem mines in the Mesa Grande district of California.

J. A. H.

**Eppler (W. E.).** Further notes on synthetic red spinel. Journ. Gemmology, 1956, **5**, 389-393, 6 figs.

A Verneuil-type synthetic red spinel gave sp. gr. 3.56-0.001 and  $n$  1.720. Curved growth lines and irregularly developed gaseous inclusions were observed, together with two-phase inclusions in form different from those usually met with in commercially produced synthetic spinels.

G. F. A.

**Breebaart (A. J.).** Synthetic moonstone-coloured spinel. Journ. Gemmology, 1958, **6**, 213-214.

A moonstone-imitation in synthetic spinel had  $n$  1.720 with sp. gr. for six stones varying from 3.639 to 3.641, suggesting the presence of corundum caused by the recrystallization of excess alumina. The moonstone appearance may be related to the reflection of light from microscopic fractures.

R. A. H.

**Brown (J. Coggin).** Sapphires of India and Kashmir. Gemmologist, 1956, **25**, 77-80, 97-100, 129-132, 3 figs.

Early Sanskrit writings gave only Ceylon as a sapphire source but, later, Kalinga and Kalpur were mentioned. Kashmir stones were first found in 1880. The history of the mines there is given. The mining area is said to have been worked out but further deposits may be found.

G. F. A.

**Webster (R.).** Ruby and sapphire. Journ. Gemmology, 1957, **6**, 101-146, 22 figs.



general article on gem corundum, with details of its principal localities, and properties. Characteristic inclusions in ruby and sapphire are considered in some detail and comparison is made with those occurring in other gem stones. There is a valuable list of references.

G. F. A.

**Ter (R.).** *The emerald.* Journ. Gemmology, 1955, **5**, 185–221, 26 figs.

A survey of the occurrence and properties of emerald and the principal localities. The imitation and synthesis of emerald is discussed together with means of distinguishing between them and the natural species. There is a long list of references.

G. F. A.

**Trson (B. W.).** *A new imitation of lapis lazuli.* Journ. Gemmology, 1954, **4**, 281–282.

A synthetic spinel, with granular appearance, has the colour of some lapis-lazuli. Cobalt was used as the coloring agent. Details of absorption spectra and other properties are given.

G. F. A.

**Trter (R.).** *Imitation turquoise from the U.S.A.* Gemmologist, 1954, **23**, 190–192.

Imitation turquoise, presumably from the U.S.A., had a sp. gr. 1.85 and  $n$  1.56. The colour was similar to that of natural material and 'veining' had been simulated.

G. F. A.

**Trter (H.).** *Tests on the bonding of artificial turquoise.* Gemmologist, 1954, **23**, 199–200.

American imitation turquoise [preceding abstract] found to have styrenated alkyd as the bonding material. Tests are given for a quick chemical test of such material. The role of the phosphoric acid radicle is discussed. It can be used as a catalyst to accelerate polymerization of the bonding material or be present as an inorganic phosphate.

G. F. A.

**Trter (R.).** *A new imitation turquoise from Germany.* Gems and Gemology, 1958, **9**, 115–117.

A brief outline of the constituents of very early and more recent imitations of turquoise with analysis of and tests on so-called 'Viennese turquoise' for purposes of comparison with the new German material. Investigations by H. E. Wehr indicate the new material as a mixture of bayerite and copper phosphate, the 'matrix' probably being some ferrous iron compound. Unnatural 'matrix' veins, low

hardness, and refractive index, and a spot test with hydrochloric acid distinguish it from natural turquoise.

J. A. H.

**Gübelin (E. J.).** *Inclusions in synthetic spinels.* Gemmologist, 1956, **25**, 153–157, 173–176, 19 figs.

A survey of the inclusions seen in synthetic spinels of recent manufacture. Most stones are comparatively free from formation characteristics, the red being excepted. The cavities found in stones of other colours are described and reasons for their formation given. Gas bubbles appear in hose-like forms, which may run parallel, criss-cross, or anastomose, and may appear like natural 'feathers'. Curved banding is rare but two-phase inclusions have been observed.

G. F. A.

**[Gnevushev (M. A.)]** Гневущев (М. А.). О следах травления на гранях алмаза. [On traces of etching on the faces of diamond.] Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1956, **85**, 401–403, 2 plates.

Corroded faces of diamond are described and discussed.

S. I. T.

**Tolansky (S.) & Howes (V. R.).** *Induction of ring cracks on diamond surfaces.* Proc. Phys. Soc., 1957, **70**, 521–526, 5 figs.

R. A. H.

**Emara (Sayeda H.) & Tolansky (S.).** *The microstructure of dodecahedral faces of diamond.* Proc. Roy. Soc., 1957, **239**, A, 289–295, 4 plates.

[M.A. 12–523]

R. A. H.

**[Futergendler (S. I.)]** Футергендлер (С. И.). Исследование включений в алмазах методом рентгеноструктурного анализа. [The study of inclusions in diamonds by the method of X-ray structural analysis.] Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1956, **85**, 568–569, 3 plates.

S. I. T.

**Patel (A. R.) & Tolansky (S.).** *The etching of crystal cleavages. II. Diamond octahedral cleavages.* Proc. Roy. Soc., 1957, **243**, A, 41–47, 5 pls.

Etch pits formed on octahedral cleavages of diamonds in a flux of  $\text{KNO}_3$  are distributed as random small pits, linear arrangements, and individual isolated pits usually larger than the others. There is a remarkable degree of

coincidence in the matching of the etch patterns on oppositely matched cleavages. It is postulated that the cleavage cuts through crystal imperfections, each such imperfection becoming the nucleus of a pit. By such etching it is shown that individual stratigraphical sheets go right through the whole crystal, and thus the whole growth history of the diamond is revealed. Small ring cracks revealed on the cleaved faces by etching are attributed to the shock of cleavage. R. A. H.

**Omar (M.) & Kenawi (M.).** *The etching of diamonds by low pressure oxygen.* Phil. Mag., 1957, ser. 8, **2**, 859-863, 4 pls.

Diamonds have been etched by heating on a molybdenum filament in a low pressure of oxygen: the etch figures obtained have the same orientation as those obtained by etching in oxidizing melts but differ in outline by being sharply triangular. They are similar, except for the inverted orientation, to the natural features called 'trigons' and it is concluded, contrary to recently accepted opinion, that the latter are also probably etch figures produced by an unknown natural process and not a growth phenomenon. [M.A. 10-325, 12-522] R. A. H.

**Tolansky (S.) & Patel (A. R.).** *Rectilinear etch pits on diamond.* Phil. Mag., 1957, ser. 8, **2**, 1003-1005, 2 pls. It is shown that the rectilinearity of etch pits on octa-

hedral faces of diamonds depends on the temperature and rate of etch. Etching in potassium nitrate at 472°C although slow produces rectilinear pits: at 525°C etching is much faster and the pits are rounded in the usual manner [c.f. preceding abstract]. R. A. H.

**[Gnevushev (M. A.), Bobkov (N. A.), & Bartoshinsky (Z. V.).** Гневушев (М. А.), Бобков (Н. А.) и Бартошинский (З. В.). Следы травления и растворения на якутских алмазах. [Traces of etching and solution on Yakutian diamonds]. Минер. Сборник Львовского Геол. Общ. [Min. Sbornik Lvov Geol. Soc.], 1957, no. **11**, 22-37, 22 figs.

Matt and corroded surfaces, cracks, pits and hummocks and other marks occurring on diamond crystal faces are described and results of goniometric measurements are given. S. I. T.

**Davidson (C. F.).** *The diamond fields of Yakutia.* Mineral. Mag., 1957, **97**, 329-338, 4 figs.

A review of the recent descriptions, in Russian, of newly discovered diamond fields in the basin of the R. Vilyui and nearby areas in the north-west of the Yakut A.S.S.R. in central Siberia. Both placer deposits and kimberlite pipes have been found and the mineralogy of the kimberlites is discussed. [M.A. 13-648, 649, 666, 668] R. A. H.

## GEOCHEMISTRY

**Aubrey (K. V.).** *Frequency-distributions of elements in igneous rocks.* Geochim. Cosmochim. Acta, 1956, **9**, 83-89, 2 figs.

It is conclusively shown that the lognormal law of Ahrens [M.A. 13-346] cannot obtain even approximately for all the major constituents of a rock; consequently many minor elements will also fail to obey the law. J. R. B.

**Turekian (Karl K.) & Kulp (J. Laurence).** *The geochemistry of strontium.* Geochim. Cosmochim. Acta, 1956, **10**, 245-296, 21 figs.

About 700 silicate rocks have been analysed for Ca and Sr (using an emission spectrographic method checked by isotope dilution analysis). Intrusive or extrusive basaltic rocks (including anorthosites and andesites) contain an average of 7.1% Ca and 465 p.p.m. Sr. Most Sr values lie between 100 p.p.m. and 1000 p.p.m. and there is no correlation of Ca with Sr when the 245 samples are con-

sidered together. In a particular province, however, the concentration range may be modest and, for example, Miocene tholeiitic basalts from Columbia River, Washington, Idaho and N.E. Oregon, United States, show increasing Sr as Ca decreases. A similar relationship holds for plagioclase from anorthosites and gabbros of the Cambrian magmatic differentiate of Stillwater, S. Montana; as Ca varies from 12.4% (An<sub>86</sub>) to 9.0% (An<sub>10</sub>) Sr varies from 141 p.p.m. to 270 p.p.m. In intrusive granitic rocks (including orthogneisses, paragneisses and granodiorites) Sr tends to increase with increasing Ca and the relationship is clear even when all the 170 analysed specimens are considered together. The average Sr content in granitic rocks thus depends on the Ca content and is taken to be 100 p.p.m. Sr when Ca is between 0.1% and 1.0% and 440 p.p.m. Sr when Ca is between 1.0% and 5.0%. The variation of Sr compared with Ca is irregular for the 23 extrusive granitic rocks analysed. The aver-



ent of 69 shales, mainly from the eastern United States, is 298 p.p.m. There is no correlation of Sr with Ca in these shales or in the 25 schists analysed and it is doubtful if the ratio Sr/Ca is a useful criterion by itself for distinguishing ortho- from para-amphibolites. J. R. B.

**For (S. R.), Emeleus (C. H.) & Exley (C. S.).** *Some anomalous K/Rb ratios in igneous rocks and their petrological significance.* Geochim. Cosmochim. Acta, 1956, 10, 224-229, 2 figs.

K and Rb were determined in 33 rocks (including gabbro, diorite, basalt, olivine basalt, andesite, trachyte, syenite, rhyolite) from Banks Peninsula, New Zealand, 4 gabbros from St. Austell, Cornwall, 19 rocks (including diorite, felsite, and granophyre) from Slieve Gullion, Armagh, Ireland, and 2 granites from the western Donegal Mountains, Co. Down, Ireland. K/Rb ratios were similar except for the rhyolites (3) from Banks Peninsula and for the granites (6) from Cornwall and Co. Down. The rocks showed Rb enrichment and it is suggested that they crystallized from an extremely differentiated magma. The Sr and Zr concentrations in these rocks are, except for the Mourne granites, markedly below these in average African granite. J. R. B.

**Булдаков (В. В.).** Особенности строения гранитного массива Майтас (Северное Прибалхашье) и распределение в нем некоторых редких элементов. [Certain features of the structure of the granite massif of Maitas (northern Sub-Balkhash region) and the distribution in it of certain rare elements.] Изв. Акад. Наук СССР, Сер. Геол. [Bull. Acad. Sci. U.R.S.S., Sér. Géol.], 1958, no. 9, 25-36, 2 figs.

Structural features, such as the joint pattern, of a pegmatitic intrusion with associated cone-sheets, are described. The metallogeny associated with these intrusions is masked by the following concentration stages: (1) Sr and Ba on early differentiates of the acid magma, (2) Mo, W, and U in the later acid and alkaline differentiates, (3) Pb, Cu, and Zn sulphides in the postmagmatic fluids. S. I. T.

**Виноградов (А. П.), Вайнштейн (Э. Е.) и Павленко (Л. И.).** Вольфрам и молибден в изверженных горных породах (к геохимии вольфрама). [Tungsten and molybdenum in igneous rocks. (Contribution to the geochemistry of tungsten).] Геохимия, Изд. Акад. Наук СССР. [Geochemistry, Publ. Acad. Sci. U.S.S.R.], 1958, no. 5, 399-408, 2 figs.

A systematic investigation of W and Mo content in various rocks has been carried out with the aid of a spectrochemical method of analysis worked out by the authors. The average content in ultrabasic rocks is, W  $7.7 \times 10^{-5}\%$ ; Mo  $2.3 \times 10^{-5}\%$ ; Mo/W, 0.3: in basic rocks W  $8.5 \times 10^{-5}\%$ , Mo  $2.2 \times 10^{-4}\%$ ; in intermediate rocks, W  $1.96 \times 10^{-4}\%$ , Mo  $1.06 \times 10^{-4}\%$ ; Mo/W, 0.55: and in acid rocks, W  $2.43 \times 10^{-4}\%$  and Mo  $1.6 \times 10^{-4}\%$ , Mo/W 0.66. It has been shown that the average Mo and W content in rocks increases in parallel with the increase of the  $\text{SiO}_2$  content in them. [Author's abstract.] S. I. T.

**[Афанасьев (Г. Д.) & Тzeitlin (С. Г.)]** Афанасьев (Г. Д.) и Цейтлин (С. Г.). Предварительные итоги изучения радиоактивности горных пород Северного Кавказа и их значение для некоторых проблем петрологии. [Preliminary conclusions of the study of rock radioactivity on the northern Caucasus and their importance for some problems of petrology]. Изв. Акад. Наук СССР, Сер. Геол. [Bull. Acad. Sci. U.R.S.S., Sér. Géol.], 1958, no. 3, 16-33, 1 fig.

New data are provided for the contents of Th and U, as well as  $\text{SiO}_2$ ,  $\text{Na}_2\text{O}$ , and  $\text{K}_2\text{O}$ , in the type igneous rocks of northern Caucasus. These rocks range from Lower Palaeozoic to Quaternary in age. The variation with age of the elements studied is outlined, and the bearing of the results on the structure of the earth's crust and the generation of magmas is discussed. S. I. T.

**Rotherham (D. C.).** *A study of some radioactive granites and pegmatites in northern Saskatchewan.* (M.Sc. Thesis, Univ. of Saskatchewan, 1955), 51 pp., 10 maps, 15 tables, 1 fig. Abstr. in Canadian Mining Journ., 1956, 77, no. 3, 70.

Radioactivity is concentrated at the margin of granite bodies. In two of the nine areas studied radioactivity is directly related to the microcline content of the rocks, suggesting that both were formed in the last stage of consolidation of the magma. W. R. G.

**Jedwab (J.).** *Les oligo-éléments dans la recherche des pegmatites minéralisées.* Ann. Soc. Géol. Belgique, 1954-55, 78, fasc. spéc., 71-79.

The author examines the possibility of foretelling the mineralization of granites and pegmatites and the intensity of mineralization of a pegmatitic zone. To the procedures in current use he proposes to add the study of trace elements in the usual minerals of pegmatites. J. M.

[**Slivko (M. M.)**] Сливко (М. М.). Примеры изменения окраски турмалина и ее геохимическое значение. [*Examples of changes of the colour of tourmaline and its geochemical significance*]. Минер. Сборник Львовского Геол. Общ. [Min. Mag. Lvov Geol. Soc.], 1957, no. **11**, 81-88, 1 fig.

It is shown that the leading chromophores which determine the colour of tourmalines are:  $\text{Fe}^{2+}\text{Fe}^{3+}$  (blue),  $\text{Fe}^{3+}$  (brown),  $\text{Cr}^{3+}$  (green),  $\text{Fe}^{2+}$  (green),  $\text{Mn}^{3+}$  (pink). The colours of successive crops of crystals or of successive zones of zoned crystals can therefore serve as indicators of the geochemical environment during the crystallization of a given variety of tourmaline. [M.A. **13**-187,203] S. I. T.

[**Ginzburg (I. I.) & Vitovskaya (I. V.)**] Гинзбург (И. И.) и Витовская (И. В.). Выветривание гранатовых, аксинитовых и тремолитовых пород в засушливых районах центрального Казахстана. [*The weathering of garnet, axinite and tremolite rocks in the dry regions of central Kazakhstan*]. «Кора выветривания», Акад. Наук СССР. [Kora vyvetrivania = Crust of weathering, Acad. Sci. U.S.S.R.], 1956, no. **2**, 299-316, 9 figs.

Products of weathering of skarns are described and a number of chemical analyses with optical, thermal, and X-ray data are given. No localities are given for the following analyses: garnet (A), from garnet skarn; nontronite (B), product of weathering of garnet; montmorillonite (C), product of weathering of hydrobiotite in an axinite skarn; pyralloite (D), product of weathering of tremolite.

	$\text{SiO}_2$	$\text{Al}_2\text{O}_3$	$\text{Fe}_2\text{O}_3$	MgO	CaO	MnO	ZnO	PbO	CuO
A	37.12	3.65	27.34	0.27	29.49	—	0.47	tr.	—
B	44.38	5.14	24.80	1.02	3.19	—	3.87	tr.	—
C	41.15	14.37	4.00	0.98	2.88	0.04	6.35	0.47	1.32
D	56.89	5.74	3.20	24.58	1.20	—	n.d.	—	n.d.
	$\text{Na}_2\text{O} + \text{K}_2\text{O}$	$\text{SO}_3$	Cl	$\text{H}_2\text{O} +$	$\text{H}_2\text{O} -$	ign. loss	free $\text{SiO}_2$	Total	
A	—	tr.	nil	—	0.45	0.84	—	99.63	
B	—	tr.	nil	2.93	12.43	1.64	—	99.40	
C	—	tr.	—	5.99	12.90	0.54	8.55	99.54	
D	0.11	—	—	3.27	4.15	0.91	—	100.05	

S. I. T.

[**Ronov (A. B.)**] Ронов (А. В.). Органический углерод в осадочных породах (в связи с их нефтеносностью). [*Organic carbon in sedimentary rocks in relation to their oil-bearing properties*]. Геохимия, Изд. Акад. Наук СССР [Geochemistry, Publ. Acad. Sci. U.S.S.R.], 1958, no. **5**, 409-423, 10 figs.

This is a statistical work based on 26,000 samples of sedimentary rocks of the Russian platform. In relation

to the time sequence the contents of organic carbon periodicity with maxima coinciding with the middles of Caledonian, Hercynian, and Alpine cycles of sedimentation. The relatively higher amounts of organic carbon are shown (1) in rocks of oil-bearing regions compared with rocks of non-oil-bearing regions; (2) in rocks of off-shore marine facies compared with continental-lagoonal facies and pelagic facies; (3) in argillaceous rocks compared with arenaceous and carbonate rocks. Several lithological and geochemical maps of the Upper Devonian argillaceous, arenaceous, and carbonate rocks of the Russian platform are given showing the distribution of organic carbon in various lithological facies. S. I. T.

[**Ljunggren (P.)**]. *Geochemistry and radioactivity of Mn and Fe bog ores*. Geol. Fören. Förh. Stockholm 1955, **77**, 33-44.

The author has examined the trace element content in some varieties of ferri-ferrous and manganiferous bog ores from western Sweden. The samples have been divided into two groups, one containing bog ores very rich in manganese and the other containing manganese-poor ores. The contents of Sr and Ba are notable and it is clear that the manganiferous bog ores are enriched in these elements. The investigation has shown that most of the elements examined are enriched in the manganiferous ores. E. Å.

[**Pearson (G. R.)**]. *Trace elements in aluminum silicates* (M.Sc. Thesis, McMaster Univ., 1955, 53 pp.). Abstr. in Canadian Mining Journ., 1956, **77**, no. 1, 69.

Determinations of Cu, Ga, Li, Cr, Ti, Mn, V, Zr, Ag, Ba, and La in aluminum silicates with four major elements analyses are used to determine the location of the minor elements in the structures. Jacobs' theory of aluminous existing in simple molecular proportions and Fairbairn's theory of distribution of minor elements in relation to packing index are examined. W. R. C.

[**Jeffs (D. N.)**]. *A spectrographic study of elements in the host rocks at Pine Point Mines, Limited*. (M.Sc. Thesis, Queen's Univ.). Abstr. in Canadian Mining Journ., 1955, **76**, no. 12, 73.

The contents of Pb, Ag, and Fe in dolomite host rocks increase within 800 feet of ore. Contents of Ni, Cu, and Ti increase near ore in lower, more siliceous aluminous beds. W. R. C.



**(A. R.).** *Geochemical investigations in the Flin Flon Area (Manitoba).* Canadian Mining Journ., 1956, **77**, no. 4, 83-86, 101.

Heavy metals accumulated in the B horizon in the podzol. The metal contents are highest in fine-grained glacial burden materials and the metals probably are held by minerals of the montmorillonite group. Metal contents of soils developed on glacial material were anomalous sulfides.

W. R. G.

**(R. W.).** *Geochemical prospecting in the Yukon.* Canadian Mining Journ., 1955, **76**, no. 6, 51-55.

Oxidation of vein materials above permafrost yielded no ground water, but Pb was fixed as anglesite, and Cu fixed as a carbonate from stream water with a pH of 8.

W. R. G.

**Volm (E. O.).** *The Yukon Territory . . . Mecca for base metals.* Canadian Mining Journ., 1956, **77**, no. 4, 63-68.

In the Pelly River area, streams contain more heavy metals—up to 0.50 p.p.m.—where they cross ore deposits. Over ore are not anomalous in metal content but soils on the sides of the ore zones are anomalously high—up to 0.50 p.p.m.—in metals. Geochemistry is useful in outlining targets for detailed study.

W. R. G.

**Wom (M. E.).** *Trace elements in Illinois Pennsylvanian limestones.* Ill. State Geol. Survey Circ., 1957, **243**, 34 pp.

Ninety-two limestone samples were taken from rock exposed in thirty-five quarries. Shales associated with some of the limestones also were sampled. Spectrochemical analyses were made for 15 trace elements and elements occurring in minor amounts, including Ba, B, Cr, Cu, Fe, Mn, Mo, Ni, K, Na, Sr, Ti, V, and Zn. The amount of these elements in Pennsylvanian limestones varies greatly. Shales associated with some of the limestones contain more water content of most trace elements than do the limestones. Those limestones containing clay or shale as an impurity are likely to contain a greater amount of trace elements than purer limestones. The average values for all limestone samples show the following abundance of elements: >0.1% — Fe, K, and Mn; <0.1 but >0.01% — Ba, Sr, and Ti; <0.01% — B, Cr, Cu, Mo, Ni, Pb, and Zn. Similar data for the average of all shale samples are: 0.1% — Fe, K, Na, Ti; <0.1 but >0.01% — B, Ba, Cr, Mn, Pb, Sr, and Zn; <0.01% — Cu, Mo and V. W. A. Wh.

**Goldsztein (M.).** *Prospection géobotanique de l'uranium dans l'Esterél.* Bull. Soc. franç. Min. Crist., 1957, **80**, 318-324, 3 figs.

The uranium content of the ashes of pine needles and other vegetation from the French Riviera bears a close relationship to the amounts of uranium found in the soils. It is suggested that geobotanical prospecting will find many applications in dry or arid regions and in places where residual soils are lacking. [M.A. **11-61**, 210, **12-45**, 402]

R. A. H.

**Hail (W. J., Jr.).** *Reconnaissance for uranium in asphalt-bearing rocks in the western United States.* Bull. U.S. Geol. Survey, 1957, no. **1046-E**, 55-85.

A total of 202 samples from 45 areas in California, Missouri, Montana, New Mexico, Oklahoma, Texas, Utah, and Wyoming, represent rocks ranging from Ordovician to Pleistocene in age.

K. S.

**Koczy (Fritz F.), Tomic (Ernst), & Hecht (Friedrich).** *Zur Geochemie des Urans im Ostseebecken.* Geochim. Cosmochim. Acta, 1957, **11**, 86-102, 4 figs.

The concentration of U, in  $\mu\text{g/litre}$ , ranges from 0.2 to 12.9 in 15 samples of river waters, and from 0.7 to 5.9 in 22 samples of Baltic sea water taken at various depths from 7 localities; U varied from 2.2 to 10.3  $\mu\text{g/litre}$  in 10 Baltic sea sediments. In some shelf zone areas U in the sea water increased slightly with salinity. High deep water values are correlated with O deficiency and it is suggested that  $\text{U}^{6+}$  is reduced to  $\text{U}^{4+}$  which forms complexes to give an insoluble organic product; the relatively high values for the sediments are thus explained. Low Ra contents in the river waters (2 samples) indicates that Ra is not in equilibrium with U; U is more readily leached from rocks than Ra.

J. R. B.

**[Ivanov (V. V.)]** Иванов (В. В.). Таллий в эндогенных месторождениях Урала. [Thallium in endogenous deposits of the Urals]. Доклады Акад. Наук СССР. [C.R. Acad. Sci. U.S.S.R.], 1958, **122**, 883-885.

The maximum amount of thallium (0.002%) is found in the copper-zinc-pyritic deposits. In pyrite deposits the thallium content is 0.0001-0.0005%. In gold-sulphide deposits the content of thallium is negligible. Thallium is present in many silicates associated with the ores.

S. I. T.

[**Sindeeva (N. D.) & Kurbanova (N. Z.)** Синдеева (Н. Д.) и Курбанова (Н. З.). О кларке селена в некоторых горных породах СССР. [*Clarke of selenium in certain rocks of the U.S.S.R.*] Доклады Акад. Наук СССР. [C.R. Acad. Sci. U.S.S.R.], 1958, **120**, 353–355.

The average of eighteen analyses of igneous rocks the clark of selenium as about  $1.4 \times 10^{-5}\%$ . His values are shown by a *Dictyonema* shale of Silurian age. S. I.

## METEORITES AND TEKTITES

*Continuation of the arranged series in M.A. 14*, pp. 45–50.

[**Pokrzywnicki (Jerez)**] Покшивницкий (Г. С.). Метеорит Мораско. Метеоритика, Акад. Наук СССР, 1958, no. **16**, 123–125, 2 figs.

**Pokrzywnicki (E.)**. *The Morasko meteorite*. Abstract: Supplement to Meteoritica, Acad. Sci. U.S.S.R., 1958, no. **16**, 20.

This siderite, weighing  $77\frac{1}{2}$  kg, was found in 1914 at a depth of  $\frac{1}{2}$  metre near Morasko in Poznań, Poland. [M.M. **21**–478; M.A. **13**–79]. Since then several other masses have been found or reported (possibly with some duplication). A recent exploration of the locality with a mine detector gave no result. An etched slice resembles a very coarse-grained hexahedrite, while the nickel content (6.65%) suggests a coarsest octahedrite.

L. J. S.

**Ramović (Mehmed)**. *Novi željezni meteorit (oktaedrit-Ogg) nađen u Bosni na planini Ozrenu između Tuzle i Doboja*. [New iron meteorite (octahedrite-Ogg) found in Bosnia on Mt. Ozren between Tuzla and Doboja.] Geološki Glasnik [Bull. Géol.], Sarajevo, 1956, pp. 35–57, 30 figs. (English summary, pp. 54–56.)

A partially oxidized mass of iron, about 3.9 kg, found near an asbestos mine in serpentine on Mount Ozren ( $44^{\circ} 36' 45''$  N.,  $18^{\circ} 20' 5''$  E.) in Bosnia was recognized in 1952 as meteoritic. It is a coarsest octahedrite, showing on a polished and etched surface kamacite, bright taenite, plessite, troilite, schreibersite and rhadite, daubréelite(?), iron hydroxides and oxides. Two analyses gave Fe 93.03 (92.72), Ni 6.82 (6.65), Co 0.37 (0.26), P 0.016 (0.09), S 0.007 (0.00), C 0.07 (0.03),  $\text{SiO}_2$  0.00 (0.01), sp. gr. 7.74 (7.80). The crust gave Fe 66.84, Ni 2.31, Co 0.09. Troilite gave Fe 63.32, Ni 0.51, Co 0.04, S 36.04, sp. gr. 4.66.

L. J. S.

[**Bonev (N.)**] Бонев (Н.). О новом центре метеоритики в Болгарии. Метеоритика, Акад. Наук СССР, 1958, no. **16**, 143–144, 1 fig. Abstract: *On the new centre of meteorites in Bulgaria*. Supplement to Meteoritica, Acad. Sci. U.S.S.R., 1958, no. **16**, 23.

Interest in the study and preservation of Bulgarian meteorites has been encouraged by the Russian Meteorite Committee. Brief notes are given of the following. [With some errors and under names differing from current catalogues.] *Trojan* (Троян, Trojan).—Near this town [ $42^{\circ} 53'$  N.,  $24^{\circ} 42'$  E.] a shower of stones fell on 18 August 1904, and six stones with a total weight of 5.469 kg were collected. Two of these have been preserved; one weighing 1.475 kg fell near the village Gumashnik (Гумашник), the other 253 g near village Debnovo (Дебново); photographs of these two are given. *Vyrba* (Върба, Virba).—At this village, near the town Belogradchik, a stone of 3.06 kg was collected in 1874. *Razgrad*.—According to Turkish accounts a meteorite fell near this town [ $43^{\circ} 42'$  N.,  $26^{\circ} 32'$  E.] about the year 1470; two pieces of about  $24\frac{1}{2}$  and  $2\frac{1}{2}$  kg were found.

L. J. S.

[**Krinov**] Krinow (E. L.). *Der Tungusker Meteorit*. Chem. Ber. der Erde, 1958, **19**, 207–229, 29 figs.

A collected account, in German, with interesting illustrations, is given from the Russian literature of the results obtained on the four expeditions led by L. A. Kulik to the place of fall in 1908 of the Tunguska meteorite. There are still many unsolved problems and another expedition is now contemplated. [M.A. **4**–261, **5**–302, **12**–250, **13**–50.]

L. J. S.

[**Evgeniev (I.) & Kuznetzova (L.)**] Евгенев (И.) и Кузнецова (Л.). За огненным камнем. [*In search of the fiery stone*.] Moscow (State Publ., Geophysical Literature), 1958, 213 pp., many figs. Price bound 4 r. 80 k.

A popular story (with some outbursts of poetry) of the four expeditions (1929–39) led by L. A. Kulik to the place of fall in 1908 of the Tunguska meteorite in central Siberia. Information collected from the inhabitants of the region and discussions with scientific colleagues on the interpretation of results are set out. Leonid Alekseevich Krinov (1883–1942) [M.M. **28**–205] was curator of the Moscow collection of meteorites, and the first scientific secretary.



Committee on Meteorites of the Academy of Sciences. These posts he was succeeded by Eugene (Евгений) Lvovich Krinov.

L. J. S.

**Yavnel (A. A.)** Явнель (А. А.). О составе Тунгусского метеорита. [*On the composition of the Tunguska meteorite*]. Геохимия, Акад. Наук СССР [Geochemistry Acad. Sci. U.S.S.R.], 1957, no. 6, 553-556, 1 pl. (English summary.)

Метеоритное вещество с места падения Тунгусского метеорита. [*Meteoritic material from the place of fall of the Tunguska meteorite*]. Астрономический Журнал, Акад. Наук СССР [Astronomical Journ.; Acad. Sci. U.S.S.R.], 1957, 34, 794-796, 1 pl. (English summary.)

Samples of soil collected in 1927-30 at the place of fall (1908) yielded small shreds of metal, which by spectroscopic analysis contained Ni 7, Co 0.7%; also minute flakes of magnetite(?). These suggest that the meteorite is an iron.

L. J. S.

**Krinov (E. L.)** Кринов (Е. Л.). Гигантские метеориты Тунгусский и Сихотэ-Алинский. [*Gigantic meteorites (Tunguska and Sikhote-Alin)*]. Изд. Акад. Наук СССР, Научно-популярная Серия. [Publ. Acad. Sci. U.S.S.R., Scientific-popular Series], 1952, 95 pp., 36 figs. Price 1 r. 45 k.

Метеориты. [*Meteorites*]. Гос. Изд. Физико-математической Литературы Вып. 8 [State Publ. Physico-math. Literature, no. 8], Moscow, 1958, 108 pp., 44 figs. Price 1 r. 65 k.

These tastefully produced booklets are abridgements of the author's text-book on meteorites. [M.A. 13-42]

L. J. S.

**Krinov (E. L.)** Кринов (Е. Л.). Обстановка падения Сихотэ-Алинского железного метеоритного дождя. Метеоритика, Акад. Наук СССР, 1958, no. 16, 39-41. Abstract: *Circumstances of the fall of the Sikhote-Alin iron meteorite shower*. Supplement to Meteoritica, Acad. Sci. U.S.S.R., 1958, no. 16, 9-12.

In an elliptical area (2.1 × 1.0 km) there is an irregular distribution of falls; 313 complete individuals (1 gramme—metric ton) and thousands of fragments were collected, with a total weight of 23 tons. The 139 craters and pits range from ½ to 26½ metres in diameter, and the ratio diam./h ranges 2.8-5.0, being lower for the larger diameters. [M.A. 10-399, 517]

L. J. S.

**[Divari (N. B.)]** Дивари (Н. Б.). Окончательные элементы атмосферной траектории Сихотэ-Алинского метеорита. Метеоритика, Акад. Наук СССР, 1958, no. 16, 37-38. Abstract: *Final elements of atmospheric trajectory of the Sikhote-Alin meteorite*. Supplement to Meteoritica, Acad. Sci. U.S.S.R., 1958, no. 16, 8-9.

The fireball of the East Siberian meteorite in 1947 was as bright as the sun and with an apparent diameter of 0.61 km. It entered the atmosphere inclined at 47° to the zenith and was seen for 3 seconds along a curved path ending at 33°. At a height of 6 km it exploded with scattering of fragments. It was followed by a trail of smoke between the heights of 33 and 4 km, which persisted for several hours. The explosion was heard over a radius of 120 km, and there were other noises and thuds. Air-waves were felt at distances of 20-30 km. [M.A. 10-399, 12-107, 252, 13-52]

L. J. S.

**[Yavnel (A. A.) & Fonton (S. S.)]** Явнель (А. А.) и Фонтон (С. С.). О механической прочности Сихотэ-Алинского метеорита. Метеоритика, Акад. Наук СССР, 1958, no. 16, 175-178, 3 figs. Abstract: *Mechanical strength of Sikhote-Alin meteorite*. Supplement to Meteoritica, Acad. Sci. U.S.S.R., 1958, no. 16, 25.

Mono-crystal rods and blocks gave the limits: tensile strength 4.4, compressive 40.6, bending 13 kg/mm<sup>2</sup>. When any intermediate layers are present the tensile strength is reduced tenfold and the compressive by 25%. L. J. S.

**[Vinogradov (A. P.), Zadorozhny (I. K.), & Florensky (K. P.)]** Виноградов (А. П.), Задорожный (И. К.) и Флоренский (К. П.). Содержание инертных газов в железном метеорите Сихотэ-Алинь. [*Content of inert gases in the Sikhote-Alin meteorite*]. Геохимия, Изд. Акад. Наук СССР [Geochemistry, Publ. Acad. Sci. U.S.S.R.], 1957, no. 6, 443-448, 12 pls., 1 fig. (English summary.)

— — — Über den Gehalt an inerten Gasen in dem Eisenmeteorit Sikhote-Alin. Chemie der Erde, 1958, 19, 275-285, 4 figs.

Three fragments of Sikhote-Alin meteorite were quantitatively analysed for isotopes of helium, argon, and neon, and the variation in their content was traced in the different zones. This, in its turn, allowed the placing together of the three fragments into their conjectural shape at the moment of falling and to calculate the shape of the original

meteorite. Other cosmological features of this meteorite are deduced from this study, such as the size of the meteorite and its age—maximum  $700 \times 10^6$  years.

S. I. T. & L. J. S.

[Kvasha (L. G.)] Кваша (Л. Г.). Минеральный состав и структура Сихотэ-Алинского железного метеорита. Метеоритика, Акад. Наук СССР, 1958, no. 16, 49–58, 12 figs. Abstract: *Mineral composition and structure of Sikhote-Alin iron meteorite*. Supplement to Meteoritica, Acad. Sci. U.S.S.R., 1958, no. 16, 13–15.

Kamacite as bands over 10 cm long and irregular in outline has the arrangement of a coarsest octahedrite. It encloses, from exsolution, many fine needles of rhabdite. Taenite and schreibersite are not prominent. Troilite contains minute grains of chromite and what appears to be  $(\text{Fe,Cr})_2\text{O}_3$ . Measurements over large areas gave: Ni-Fe 98.30, schreibersite 1.40, troilite and chromite 0.30 wt.%. Fragmented specimens (which have struck rocks) show a distorted structure and bending of Neumann lines. Near the fusion crust of large specimens and surface flakes the kamacite is granulated. [M.A. 10-399] L. J. S.

[Kolomensky (V. D.) & Yudin (I. A.)] Коломенский (В. Д.) и Юдин (И. А.). Минеральный состав коры плавления метеорита Сихотэ-Алинь, а также метеоритной и метеорной пыли. Метеоритика, Акад. Наук СССР, 1958, no. 16, 59–66, 4 figs. Abstract: *Mineral composition of the fusion crust of the Sikhote-Alin meteorite, the meteoritic and meteoric dust*. Supplement to Meteoritica, Acad. Sci. U.S.S.R., 1958, no. 16, 15–16.

The fusion crust (0.1–1.0 mm thick) is in two zones. The outer one consists mainly of oxymagnetite (cell-edge  $a$  8.382 kX) with some iozite ( $a$  4.284 kX) and rare grains of kamacite ( $a$  2.863 kX). The oxymagnetite is intermediate between magnetite ( $\text{Fe}^{II}\text{Fe}_2^{III}\text{O}_4$ ) and maghemite ( $\text{Fe}^{III}\text{Fe}_2^{III}\text{O}_4$ ). The inner zone consists of kamacite ( $a$  2.864 kX) with oxymagnetite ( $a$  8.383 kX) and iozite ( $a$  4.284 kX). Meteorite dust, swept off the surface during flight of the meteorite in the atmosphere, consists of spherical globules and particles of nickel-iron, oxymagnetite, and magnetite. [M.A. 12-252, 605, 13-47] L. J. S.

[Dyakonova (M. I.)] Дьяконова (М. И.). Химический состав Сихотэ-Алинского метеорита. Метеоритика, Акад. Наук СССР, 1958, no. 16, 42–48. Abstract: *Chemical composition of Sikhote-Alin meteorite*. Supplement to Meteoritica, Acad. Sci. U.S.S.R., 1958, no. 16, 12–13.

To obtain an average sample for analysis six specimens (each of 20 kg.) were sliced and the cuttings mixed. Troilite and schreibersite were separated. Nickel-iron, analyzed (P dissolved and included rhabdite): troilite, B (alloy 1.06%) : schreibersite, C : bulk composition of the meteorite, D : kamacite (the main constituent), Ni 5.93% : chromite, Cr<sub>2</sub>O<sub>3</sub> 71.23, FeO 15.91, MgO 11.87, = 99.01; sp. gr. 4.6.

	Fe	Ni	Co	Cu	P	S	Total	Sp. gr.
A	93.32	6.00	0.47	0.03	0.28	0.00	100.10	
B	62.46	—	—	0.05	—	34.65	98.22	
C	69.76	14.81	0.15	—	15.23	—	99.95	
D	93.29	5.94	0.38	0.03	0.46	0.28	100.38	

[M.A. 12-251, 13-358]

L. J.

Heide (F.). *Der meteoreisenregen von Sikhote-Alin*. Chemie der Erde, 1958, 6, 447–450.

An outline account in German, taken from the extensive Russian literature, of the large shower of meteoritic material at Sikhote-Alin in 1947.

L. J.

[Kvasha (L. G.)] Кваша (Л. Г.). Петрографическое исследование каменного метеорита Никольское. Метеоритика, Акад. Наук СССР, 1958, no. 15, 97–104, 8 figs. Abstract: *A petrographic analysis of the stony meteorite Nikolskoye*. Supplement to Meteoritica, Acad. Sci. U.S.S.R., 1957, no. 15, 6–7.

This meteorite [M.A. 13-359] fell at Nikolskoe, 38 km north-west of Moscow, where the fireball was seen. The total weight of the nine fragments collected is 5236.5 g, the largest piece 2704.4 g. It is a friable chondrite consisting of 80–90 vol.% of chondrules ranging in size from 0.05 to 4 mm, the majority about 2 mm. Many photomicrographs show the various types and structures of the chondrules. The mineral composition of the meteorite is: olivine 76.6, bronzite 17.2, nickel-iron 4.41, troilite 2.21, chromite 0.30 vol.%. From the optical data, the olivine contains 25 mol.%  $\text{Fe}_2\text{SiO}_4$ , and the bronzite 17–20 mol.%  $\text{FeSiO}_3$ .

L. J. S.

[Zotkin (I. T.) & Krinov (E. L.)] Зоткин (И. Т.) и Крinov (Е. Л.). Исследование условий падения каменного метеорита Никольское. Метеоритика, Акад. Наук СССР, 1952, no. 15, 82–96, 8 figs. Abstract: *An investigation of the circumstances of the fall of the stony meteorite Nikolskoye*. Supplement to Meteoritica, Acad. Sci. U.S.S.R., 1957, no. 15, 5–6.

The Nikolskoe meteorite fell at 15.22 (G.M.T.) on 6 March, 1954. The fireball was seen for 5 seconds.



s of 44.6 and 10.8 km; it then broke up, and nine  
ents were collected from an area 1 km across. The  
velocity of the flight was 9.2 km/sec, and at the end  
4 km/sec. Apparently the meteorite in its course  
atching up with the earth.

L. J. S.

**in (I. T.) & Krinov (E. L.)** Зоткин (И. Т.) и Кринов  
Е. Л.). Исследование условий падения каменного  
метеоритного дождя Кунашак. Метеоритика, Акад.  
Наук СССР, 1958, no. **15**, 51-81, 9 figs. Abstract:  
*An investigation of the circumstances of the fall of the  
Kunashak stony meteoritic shower.* Supplement to  
Meteoritica, Acad. Sci. U.S.S.R., 1957, no. **15**, 4-5.

A shower of stones fell at 8.14 a.m. local time (3.14  
G.) on 11 June, 1949 [M.A. **12-249**]. The large (250  
cm diam.), bright, whitish-yellow fireball was first seen  
at a height of 100 km, increasing in brilliancy with sparking  
to 10 km, and ending at 19.6 km; velocity 26.7 km/sec.  
The largest stone (120 kg) broke into fragments on falling;  
more than 200 kg were collected. [M.A. **12-244**, **13-45**,  
**18**, 360]

L. J. S.

**zin (R. L.)** Дрейзин (Р. Л.). Результаты изучения  
обстоятельств падения каменного метеоритного дождя  
Крымка. Метеоритика, Акад. Наук СССР, 1958,  
no. **16**, 105-106, 1 pl. (map). Abstract: *Results  
of the study of the circumstances of the fall of the Krymka  
stony meteorite shower.* Supplement to Meteoritica,  
Acad. Sci. U.S.S.R., 1958, no. **16**, 18.

This shower fell at 19 h. (Moscow time) on 21 January,  
in the Odessa region, Ukraine. During ten years  
specimens (total weight 50 kg) have been collected.  
Some are completely crusted and others are singed on  
surfaces, indicating that there were two explosions  
at different heights. [M.A. **11-528**, **12-105**, **13-360**]

L. J. S.

**povich (I. S.)** Астапович (И. С.). Условия падения  
каменного метеоритного дождя Первомайский Поселок.  
Метеоритика Акад. Наук СССР, 1958, no. **15**, 31-50,  
8 figs. Abstract: *The circumstances of the fall of the  
stony meteoritic shower Pervomaisky Posyolok.* Supplement  
to Meteoritica, Acad. Sci. U.S.S.R., 1957, no. **15**, 3-4.

A bright fireball was seen at 14.42 (G.M.T.) on 26  
November, 1933, at many places (including Moscow,  
8 km south-west from the place of fall). The circular

bolide (40 metres diam.) was at first white changing to  
blue-green at the end with showers of sparks; velocity  
18 km/sec. A shower of stones fell around Pervomaisky  
Poselok (56° 38' N., 39° 23' E.); 99, with a total weight of  
66 kg, were collected. [M.A. **7-62**, **9-294**, **295**, **10-172**,  
**511**, **12-244**, **13-45**, **49**, **178**, **360**]

L. J. S.

**[Astapovich (I. S.)** Астапович (И. С.). Исследование  
условий движения каменного метеорита Старое  
Песьяное. Метеоритика, Акад. Наук СССР, 1958,  
no. **15**, 3-30, 8 figs. Abstract: *An investigation  
of the conditions of motion of the stony meteorite, Staroye  
Pesyanoye.* Supplement<sup>1</sup> to Meteoritica, Acad. Sci.  
U.S.S.R., 1957, no. **15**, 3.

A brilliant fireball was seen, and noises heard, at 5.10 a.m.  
(local time) on 2 October, 1933, over a wide area in Kurgan  
district, West Siberia. From the reports of many observers  
the length of the visible path is calculated as 120 km,  
beginning at a height of 140 km and ending at 42.8 km.  
It was seen for 8.1 seconds, giving an aerial velocity of  
14.8 km/sec. The orange-yellow bolide was pear-shaped  
with a diameter of 40 metres and length 52 metres. The  
following smoke trail was convoluted and persisted for  
several hours. The meteorite is very brittle and 15 pieces,  
with a total weight of 3393g were collected around Staroe  
Pesyanoe (55° 30' N., 66° 5' E.); others fell in a lake. [It  
is an enstatite-achondrite (chladnite). M.A. **9-294**, **295**,  
**13-42**]

L. J. S.

**[Vorobyev (G. G.) & Namnandorzh (O.)** Воробьев (Г. Г.)  
и Намнандорж (О.). Метеориты Монголии.  
Метеоритика, Акад. Наук СССР, 1958, no. **16**,  
134-136. Abstract: *Meteorites of Mongolia.*  
Supplement to Meteoritica, Acad. Sci. U.S.S.R.,  
1952, no. **16**, 22.

*Alzhi-Bogdo I* (Алжи-Богдо).—Polymict brecciated  
chondrite, found 1949, 910g, 44° 50' N., 95° 10' E. [=Kobdo,  
M.A. **13-52**, 360]. *Alzhi-Bogdo II*.—Iron, found before the  
middle of last century, 70 × 50 × 45 cm, 44° 52' N., 95° 25' E.  
[perhaps confused with Armanty, M.A. **10-174**, **12-106**].

*Khenteisky* (Хэнтэйский).—Stone, fell 23 h. 30 m. local  
time, 10 July, 1952, four pieces, the largest 403.1g.

(<sup>1</sup>) Detailed English summaries of the twelve articles in  
Meteoritica, no. **15**, are given in a 10-page leaflet. These  
have been reprinted, together with abstracts of some other  
recent Russian papers on meteorites, in Geochim. Cosmo-  
chim. Acta, 1957, vol. **13**, pp. 70-79.

*Manlai* (Манлай).—Iron, known several decades ago, recovered 1954, 95 × 40 × 25 cm, 44° 20' N., 106° 30' E.

*Matad* (Марад).—Stone, 189.5 g., 47° 36' N., 114° 45' E.

*Noyan-Bogdo* (Ноян-Богдо).—Stone, fell September, 1933, 40–50 cm, broken up, some fragments preserved, 42° 55' N., 102° 28' E. [=Noen, M.A. 13–52].

*Kerulensky* (Керуленский).—Pseudo-meteorite, numerous glassy fragments, fell [?] 24 March, 1950. L. J. S.

**Henderson (Edward P.) & Furcron (A. S.).** *Meteorites in Georgia. Part 2: Description of falls.* Geologia, Mineral Newsletter (Georgia Geol. Surv.), 1957, **10**, no. 4, 113–142, 38 figs.

A connected account, with excellent illustrations, is given of 21 meteorites known from Georgia, U.S.A. The earliest is Forsyth, a chondrite of 36 lb observed to fall in 1829. Two previously not recorded are: *Pulaski County* (32° 15' N., 83° 30' W.), a fragment of 116 g found on the surface in 1955, is a coarse octahedrite with some cohenite; *Twin City*, Emanuel Co. (32° 35' N., 82° 1' W.), an oxidized, fissured, and broken mass of about 11½ lb found in 1955 when making a road, is a nickel-rich ataxite (Ni 29.91, Co 0.51%) with some schreibersite; it shows spindles of oxidized kamacite in a base of taenite, and is similar in structure to Lime Creek (Alabama, 1834). L. J. S.

**Henderson (Edward P.) & Perry (Stuart H.).** *Studies of seven siderites.* Proc. United States Nat. Mus., 1958, **107**, 339–403, 23 pls., 6 figs.

A biographical note with portrait is given of S. H. Perry (1874–1957). These studies are supplementary to his 1944 monograph [M.A. 9–290], clearing up doubtful points. *Breece*, New Mexico, medium octahedrite, found 1921 [M.M. 29–531].—New analysis (A) by Henderson. The material previously identified as cohenite is schreibersite (anal. B); X-ray spacings listed. Very little carbon as black particles is perhaps pseudomorphous after cohenite. *Cincinnati*, Ohio, nickel-poor ataxite, found 1870 [M.A. 6–390].—Anal. C shows more P than the earlier analysis, part of which is soluble in dil. HCl, suggesting absorption in kamacite due to reheating. *Goose Lake*, California, octahedrite, 2573 lb, found 1938 [M.A. 7–379, 543, 8–61].—Anal. D. Curious cavities, deep and sometimes penetrating through the meteorite, are believed to be of primary origin. *Keen Mountain*, Buchanan County, Virginia (37° 13' N., 82° 0' W.), hexahedrite, 14½ lb, found 1950, not previously recorded.—Anal. E. Rhabdite (Ni 37.7%) in broken

segments suggests reheating. *Pittsburgh*, Pennsylvania, coarse octahedrite, found 1850.—New analysis F, rhabdite and cohenite 0.76%. *Soroti*, Uganda, fell [M.A. 10–400, 11–269]. This is a new type of meteorite for which the name *sorotite* is proposed. It consists of nodules of troilite 46.747 wt.% (59.46 vol.%) set in a matrix of nickel-iron, analogous to pallasite. The nickel is (Fe 85.41, Ni 12.96, Co 0.62, schreibersite 1.01%) and kamacite bands (<1 mm) with taenite and pleonaste. *Tombigbee*, Alabama, hexahedrite, found 1859.—Groundmass kamacite (anal. G) contains more Ni than the 'swathing kamacite' (anal. H) surrounding large inclusions of schreibersite (anal. I) and they differ in hardness. Rhabdite needles, Ni 19.53, Co 0.52%.

	Fe	Ni	Co	P	S	C
A	89.627	9.167	0.635	0.571	trace	trace
B	59.93	24.18	0.01	15.75	—	0.002
C	94.12	5.33	0.74	1.26	0.006	—
D	90.80	8.39	0.42	0.12	0.00	—
E	93.38	5.65	0.73	0.19	nil	0.06
F	91.6	6.77	0.66	0.12	0.018	—
G	95.09	4.28	0.63	nil	—	—
H	95.64	3.78	0.58	—	—	—
I	71.78	12.03	0.58	15.59	—	—

L. J. S.

**Leonard (Frederick C.).** *The Franklin, Kentucky, meteorite.* (CN=0866,367). Publ. Astron. Soc. Pacific, 1957, **69**, 450–462, 1 pl.

A stone of 9.062 kg, with oxidized crust, was ploughed up near Franklin [36° 43' N., 86° 34' W.] in 1921 (recognized 1956). It is classed as a "black, crystalline, spherulitic [i.e. spherical] chondrite", with much nickel-iron.

L. J. S.

**Leonard (Frederick C.).** *The Amber, Oklahoma, meteorite.* (CN=0979,351). (Abstract). Meteoritics, Albuquerque, New Mexico, [1957], **1**, no. 4 (for 1957), 490–491.

A weathered stone weighing 4.532 kg was found in 1955 (recognized in 1955) near the town of Amber (35° 13' N., 97° 9' W.). It is a black, crystalline, spherical chondrite with much nickel-iron. It is similar to Cushion [M.A. 12–360], Kingfisher Co., and may belong to a widespread shower.

L. J. S.

**Hardy (Clyde T.).** *Duchesne and Altonah meteorites.* Utah Acad. Sci. Arts Lett., 1958, **35** (for 1957), 105–107.



the place where the Duchesne meteorite [M.A. 4-118] was found, is exactly located at  $40^{\circ} 23' \text{ N.}$ ,  $110^{\circ} 52' \text{ W.}$ . A sample (19 lb) of the 50 lb mass is in the University of California. 'Mount Tabby' (G. P. Merrill, 1922) from the same locality is identical with Duchesne. 'Altonah' (H. H. Engel, 1933), located at  $40^{\circ} 34' \text{ N.}$ ,  $110^{\circ} 29' \text{ W.}$ , is also identical. L. J. S.

**Or (George).** *Alleged meteorite from Horsham, Victoria.* Mem. Nat. Mus. Victoria, 1957, no. 21, 72-78, 2 figs.

A pseudo-meteorite collected in 1924 is shown to be the same as ash (glassy slag) from a burnt haystack. A detailed analysis gives  $\text{SiO}_2$  6.04,  $\text{Na}_2\text{O}$  10.63,  $\text{K}_2\text{O}$  11.53%, &c.;  $d = 2.00$ ,  $n = 1.530-1.535$ . L. J. S.

**Delga y Recarte (Antonio).** *Hiero meteorico encontrado en Villanueva del Fresno (Badajoz).* Notas Comun. Inst. Geol. Minero, España, 1953, no. 30, 35-41, 3 plgs., 1 fig.

A piece of 132g is incompletely described. An etched surface suggests manufactured iron; all other figures show the structure of meteoritic iron from foreign sources. Apparently a pseudo-meteorite from the same locality where ancient slags have been found. M.A. 12-380] L. J. S.

**Stainga (R.) & Fredriksson (K.).** *Analysis of cosmic spherules with an X-ray microanalyser.* Geochim. Cosmochim. Acta, 1958, 14, 114-117, 2 pls.

Spherules from deep-sea deposits consist mostly of iron oxides with sometimes a nucleus of nickel-iron enriched in nickel (up to 50%) and cobalt. [M.A. 12-605] L. J. S.

**Edge (T. W.) & Wildt (R.).** *A search for airborne particles of meteoritic origin.* Geochim. Cosmochim. Acta, 1958, 14, 126-133, 2 pls., 3 figs.

Magnetic globules ( $3-15\mu$  diam.), collected in Arctic and desert regions, resemble those ablated from the surface of meteorites during flight in the earth's atmosphere and collected from the soil where meteorites have fallen. In industrial areas the magnetic particles are more irregular in form and larger in size. [M.A. 11-265, 266, 13-47] L. J. S.

**Fredriksson (Hans).** *Rate of accretion of cosmic dust on the earth.* Nature, London, 1958, 181, 330.

Filtering 1000 cubic metres of air on the top of Mt.

Haleakalā, Hawaii, gave Fe  $1577\mu\text{g}$  and Ni  $14.3\mu\text{g}$ , from which is calculated that 14.3 million tons of meteoritic dust fall annually on the earth. [M.A. 11-266] L. J. S.

**[Krinov] Krinow (E. L.).** *Meteoritenkrater auf der Erde.* Urania, 1958, Heft 10, 377-382, 6 figs.

A general review of the literature on meteorite craters on the earth. L. J. S.

**Beals (C. S.).** *A survey of terrestrial craters.* Nature, London, 1958, 181, 559.

Circular areas are noted on aerial photographs from several places in Canada. It is suggested that some of these may perhaps be meteorite craters. [M.A. 11-272, 532, 13-54] L. J. S.

**Gilvaray (J. J.) & Hill (J. E.).** *The impact of large meteorites.* Astrophys. Journ., 1956, 124, 610-622, 5 figs.

Mathematical, without any reference to explosive meteorite craters and to the largest known meteorites found on the surface of the ground. L. J. S.

**Rinehart (John S.).** *A soil survey around the Barringer Crater.* Sky & Telescope, 1957, 16, 13 figs. (Reprint 7 pp.).

Soil samples, taken over an area of nearly 90 sq. miles around the meteorite crater in Arizona, contain about 0.5% of magnetic material (nickel-iron and oxide). The total amount is estimated at 12,000 tons. Distribution of the material suggests that the meteorite arrived from the W.S.W. [M.A. 11-445, 13-47] L. J. S.

**[Aaloe (A.)]** Аалоз (А.). Новые данные о метеоритных кратерах на острове Саарема Эстонской ССР. Метеоритика, Акад. Наук СССР, 1958, no. 16, 108-114, 7 figs. Abstract: *New data on the meteorite crater of Saaremaa island, Estonian SSR* Supplement to Meteoritica, Acad. Sci. U.S.S.R., 1953, no. 16, 19.

A new exploration of the smallest crater (no. 5,  $13 \times 11\frac{1}{2}$  metres) resulted in the collection, with a magnet, of numerous fragments and jagged flakes of meteoritic iron; the largest 8.62g, total weight 450g. Outside the crater a few fragments, and also globules of magnetite, were collected. A magnetic survey of crater no. 3 showed only slight anomalies. [M.A. 10-181; M.M. 25-75] L. J. S.

**Merriam (Richard) & Holwerda (James G.).** *Al Umchaimin, a crater of possible meteoritic origin in western Iraq.* Geogr. Journ. (Roy. Geogr. Soc. London), 1957, **123**, 231-233, 1 pl., 1 fig.

A circular crater has long been known 90 km W.S.W. of Rutba. It is 3.2 km across and the rim is 25-35 metres above the level floor with a pool of water. The slopes are deeply cut by gullies showing steps in the horizontally bedded Eocene limestone. There are no outer slopes and the surrounding area is covered with weathered chert nodules with a coating of manganese oxide. Various modes of origin are suggested—solution, sink-hole, salt-dome, wind erosion, volcanic (no volcanic rocks), meteoritic (no meteoritic material found). There are no shattered rocks and the bedding of the limestone is not disturbed [suggesting that the origin cannot be meteoritic]. L. J. S.

**Baker (George).** *The role of australites in aboriginal customs.* Mem. Nat. Mus. Victoria, 1957, no. **22**, pt. 3, 23 pp., 4 pls.

Witch-doctors use australites to produce good or bad results; they are carried as lucky charms; fragments are rarely used as implements (scrapers) and weapons. A map shows their distribution in southern Australia and Tasmania. L. J. S.

**Baker (George).** *The role of aerodynamical phenomena in shaping and sculpturing Australian tektites.* Amer. Journ. Sci., 1958, **256**, 369-383, 3 figs.

Predominantly spherical primary shapes, generated before reaching the atmosphere, were modified by atmospheric forces generated at the ultra-supersonic and supersonic speeds with which these objects approached the earth. Each australite was considerably reduced in bulk by passing through the atmosphere. Most of the change occurred on the front and side ('equatorial') surfaces through processes of ablation and thin-film fusion-stripping, but circumferential, spirally-coiled flanges were built up along the sides of the otherwise unaffected back, or lee surfaces. Previously unexplained, thin, disc-like shapes represent the final stage of almost complete transformation of an initial sphere into such a flange, with little or none of the original solid left unaltered. The final form of the front surface should be nearly parallel to the frontal shock wave pushed ahead of each meteor during the last part of its supersonic flight. Many (perhaps all) details of charac-

teristic and variant shapes are described, and can be explained under the author's theory. [M.M. **30-5**, M.A. **13-83**] H. W.

**Mason (Brian [H.]).** *Chemical composition of tektites.* Nature, London, 1959, **183**, 254-255.

It is sometimes stated that in composition tektites are nearer to sedimentary rocks than to igneous rocks. A paired comparison of 7 tektites (Libyan Desert silica-glauconite,  $\text{SiO}_2$  97.58% to Ivory Coast tektite,  $\text{SiO}_2$  68.60%) with granitic rocks (H. S. Washington's tables, 1917) shows substantial agreement. L. J. S.

**Barnes (V. E.).** *Properties of tektites pertinent to their origin.* Geochim. Cosmochim. Acta, 1958, **14**, 267-278, 1 pl.

The various theories of the origin of tektites are discussed in relation to their chemical composition, enclosed particles of 'lechatelierite' [cristobalite, M.M. **25-436**], two periods of melting, flow structures, shapes and sizes, geographic distribution, and ages. No theories or suggestions satisfy all these conditions. The author favours the view that tektites are derived [but how?] from sedimentary rocks. Probably of terrestrial origin, it being considered that the 'lechatelierite' represents fused grains of quartz. An alternative view is that tektites are meteorites from the siliceous zone of a disrupted planet. [M.A. **8-62**] L. J. S.

**Friedman (Irving), Kohman (Truman), & Cassidy (William A.).** *Tektites.* Science (Amer. Assoc. Adv. Sci.), 1958, **127**, 91-94.

A conference on the problems of tektites, held on 17-18 June, 1958, at the National Academy of Sciences in Washington, was attended by twenty workers, with a few foreign contributions. A dozen papers were presented and discussed, but without any decisive result, although a terrestrial origin was generally favoured. Suggestions for further work were considered. L. J. S.

**O'Keefe (John A.), Varsavsky (Carlos M.), & Gold (Thomas).** *Origin of tektites.* Nature, London, 1958, **181**, 172-173.

Three notes discussing the suggestion of H. H. Nininger that tektites have been projected from meteorite craters on the moon [M.A. **8-63**]; 'Chips from the blasted moon' [M.A. **10-183**]; 'Out of the sky' [M.A. **11-515**]. G. Linck [M.A. **3-539**] had previously suggested volcanic bombs from the moon. In the absence of any positive data, the results are negative. L. J. S.



(Virgil E.), Kopal (Zdeněk), Urey (Harold C.). *Origin of tektites*. Nature, London, 1958, **181**, 1457-1458.

See more notes with further discussion and criticisms.

L. J. S.

(Harold C.). *On the origin of tektites*. Proc. Nat. Acad. Sci. U.S.A., 1955, **41**, 27-31.

Critical review. "Tektites are most reasonably regarded as terrestrial in origin". [M.A. **13**-363]

L. J. S.

(A. J.). *The absorption spectra of tektites and other natural glasses*. Geochim. Cosmochim. Acta, 1958, **14**, 279-286, 5 figs.

These authors compare the infra-red spectra for various types of glasses (including silica-glass from the Libyan Desert and Boulton crater) with those for volcanic and artificial glasses. A prominent band, due to ferrous iron, is at  $2\mu$ . [M.A. **12**-613]

L. J. S.

(W. H., Jr.), Fairbairn (H. W.), Herzog (L. F.), & Formier (R. F.). *Sr/Rb age study of tektites*. Bull. Geol. Soc. Amer., 1957, **68**, 1780 (abstract).

Tektites contain very little Sr and Rb, and any estimate of their age is liable to a 50% error. In nine determinations, ranging from 180-730, the average is 380 million years. This is less than that for meteoritic stones and higher than for terrestrial volcanic glass.

L. J. S.

(Irving). *The water, deuterium, gas and uranium content of tektites*. Geochim. Cosmochim. Acta, 1958, **24**, 316-322, 1 pl., 3 figs.

Several types of material were examined: methods and results are described. Water  $<0.05\%$  (average  $0.005\%$ ); deuterium ratio  $0.01-0.0166$  mole%, within the range for terrestrial materials; no gas detected; pressure in cavities very low; uranium  $1-3$  p.p.m. These data favour a terrestrial origin, but an extra-terrestrial source is not ruled out.

L. J. S.

(William D.). *Cosmic-ray-induced radioactivities in meteorites and tektites*. U.S. Atomic Energy Comm., Rep. no. NYO-6634. Doct. Diss. Dept. Chem., Carnegie Inst. Tech., Pittsburgh, 1957, xii+122 pp., 10 figs. Mimeographed.

Special arrangements of Geiger counters enabled the detection of radioactivity to be detected. Chemical precautions

were taken for the concentration and purity of the materials, terrestrial Al, Be, Co being added as carriers. With meteorites (2 siderites, 2 stones) and tektites (moldavites, australites, bediasites, and silica-glass from the Libyan Desert) radiations from  $^{26}\text{Al}$ ,  $^{10}\text{Be}$ , or  $^{60}\text{Co}$  were detected in most cases; terrestrial materials (granite, obsidian, cobalt ore) gave smaller values, from which it is concluded that all the former had been exposed to cosmic rays in space. Australites and the silica-glass are thought to have arrived on the earth's surface less than four million years ago (i.e. four half-lives of  $^{26}\text{Al}$ ); but in the case of meteorites of known dates of fall further assumptions are called for.

L. J. S.

Ehmann (W. D.) & Kohman (T. P.). *Cosmic-ray-induced radioactivities in meteorites—I. Chemical and radio-metric procedures for aluminium, beryllium and cobalt*. Geochim. Cosmochim. Acta, 1958, **14**, 340-363, 5 figs.

— — — II.  $\text{Al}^{26}$ ,  $\text{Be}^{10}$  and  $\text{Co}^{60}$ , aerolites, siderites and tektites. Ibid., 364-369.

Abbreviated and edited accounts of the above mimeographed thesis.

L. J. S.

Kohman (Truman P.). *Are tektites extra-solar-system meteorites?* Nature, London, 1958, **182**, 252-253.

The increased amount of  $^{26}\text{Al}$  and  $^{14}\text{Be}$  (preceding abstract), due to cosmic rays, could have been collected by loose clusters of glassy objects wandering in space outside the gravitational influence of the solar system.

L. J. S.

Urey (Harold C.). *Origin of tektites*. Nature, London 1958, **182**, 1078.

Further discussion, and criticism of T. P. Kohman [see preceding abstract].

L. J. S.

Koenigswald (G. H. R. von). *Tektites from Java*. Proc. Koninkl. Nederl. Akad. Wetensch., 1957, ser. B, **60**, no. 5, 371-382, 4 pls.

Tektites from the Australasian group of upper middle Pleistocene age are dealt with. The javanites form one of the provinces in this group and differ from other provinces on the basis of surface structures and chemical composition. Analyses of six Javanese tektites are given. They are 'obsidian-black' in colour and have sp. gr. between 2.3940 and 2.4607, refr. ind. 1.51. The tektites are regarded as of cosmic origin.

P. C. Z.

**Koenigswald (G. H. R. von).** *A tektite from the island of Flores (Indonesia).* Proc. Koninkl. Nederl. Akad. Wetensch., 1958, ser. B, **61**, no. 1, 44-46, 1 fig.

A black tektite without lustre and of the deformed core

type is described. The deformation is discussed. found in the neighbourhood of *Stegodon* remains and upper middle Pleistocene age. P. C.

## MINERAL DATA

**Mélon (J.) & Toussaint (J.).** *Evansite et apatite du Kivu.* Ann. Soc. Géol. Belgique, 1956-57, **80**, B, 496-501, 1 fig.

These minerals come from Kobokobo, Kivu, Belgian Congo. Evansite forms a greenish yellow, botryoidal or globular incrustation; H. 5, sp. gr. 2.13; has spherulitic structure of concentric growth zones; partly anisotropic,  $n$  1.50; appears amorphous to X-rays. It contains numerous orientated dark brown inclusions; is feebly radioactive (thorium). Its dehydration is studied. Analysis gave  $P_2O_5$  23.20, oxides 39.75,  $H_2O$  36.70, the oxides comprising  $Al_2O_3$ ,  $Fe_2O_3$ , and rare earths and thorium. The classical formula of evansite  $Al_3PO_4(OH)_6 \cdot 6H_2O$  is not correct; there is probably no OH group. With evansite is found a fluorapatite, of the consistency of chalk, formed of minute terminated crystals. J. M.

**Toussaint (J.).** *Sur la fibroferrite et ses produits de déshydratation.* Ann. Soc. Géol. Belgique, 1955-56, **79**, B, 45-52, 1 fig., 1 pl.

Fibroferrite is monoclinic, fibres  $\parallel c$ ;  $a$  7.45,  $b$  12.10,  $c$  7.65 Å,  $\beta$  110° 7'; X-ray powder data are given. Dehydration is studied by the Chevenard thermobalance. The monoclinic phase is stable up to 50°C; from 80° to 300° there is a rhombohedral phase; from 300° to 500° the symmetry is orthorhombic. Each phase is described. The fibre axis remains practically invariable throughout the transformations. J. M.

**Van Tassel (R.).** *Note sur la jarosite et la destinezite d'Argenteau.* Publ. Assoc. Étude Paléont. Stratigr. Houillères, Brussels, 1956, no. **25**, 95-98.

Both minerals occur associated with Namurian sediments near Liège, Belgium. X-ray powder data are given and also a new analysis of destinezite:  $H_2O$ -9.48,  $H_2O$ + 18.28,  $Fe_2O_3$  37.18,  $P_2O_5$  16.44,  $SO_3$  17.53, insol. res. 1.22, = 100.13. J. Ph.

**Van Tassel (R.).** *Jarosite, natrojarosite, beaverite, leonhardtite et hexahydrate du Congo belge.* Bull. Inst. roy. Sci. nat. Belgique, 1958, **34**, no. 44, 12 pp.

Microcrystalline yellow coatings and crusts of jarosite and natrojarosite are found on gypsum and sandstones at different localities [M.M. 31-813]. Powdery beaverite [M.A. 12-362] occurs together with pyromorphite, pseudomalachite, and quartz at Kipushi, Katanga. Analysis of beaverite from Beaver County, Utah, and of iron-bearing Kipushi material (in parenthesis) gave:  $H_2O$ -0.17 ( $H_2O$ + 8.12 (n.d.),  $Fe_2O_3$  17.99 (14.8),  $Al_2O_3$  3.51 ( $PbO$  29.87 (20.9),  $CuO$  11.69 (7.5),  $Na_2O$  n.d. ( $K_2O$  n.d. (0.11),  $SO_3$  22.92 (12.4), insol. res. 5.92 (mainly quartz), = 100.19 (93.63). Gypsum, leonhardtite ( $n > 1.496$ ,  $< 1.520$ ), and hexahydrate ( $\alpha$  1.436,  $\gamma$  1.436) [M.A. 11-517] are recognized in a sample collected in the Congo at the river Difirinjé. The occurrence of these magnetic minerals in situ, at this spot, is accepted with reservation. X-ray powder data are given for all minerals. J. M.

**Winchell (Horace).** *Optics of the eosphorite-childrenite series.* Amer. Min., 1958, **43**, 765-768, 1 fig.

The optical data of Hurlbut [M.A. 11-407] for this series show two apparently discontinuous changes: (a) for eosphorite half of the series  $\alpha \parallel b$ ,  $\gamma : c$  3°-8°, for childrenite  $\alpha \parallel b$ ,  $\beta : c$  6°-8°; (b) for manganoan childrenite there are no data but the dispersion of 2V also reverses. Least squares evaluation of some of the optical variables supports the conclusion that this series is isomorphous but with a shift in the above optical properties. B. H.

**Young (E. J.).** *An occurrence of gorceixite in Arkansas.* Amer. Min., 1958, **43**, 762-765, 2 figs.

Gorceixite ( $BaAl_3(PO_4)_2(OH)_5 \cdot H_2O$ ) has been found 10 miles from Hot Springs, Arkansas. It is in the form of spheroids with radially arranged fibrous crystals. Unlike crystals are length positive with parallel extinction. Refr. ind. approx. 1.61. A semiquantitative spectrographic analysis shows Al and P major, with wgt. % 7 Ba and 3 Sr, 1.5 Ca, 0.3 Si, As and U, 0.15 Y and V, and 22 elements 0.07 or less down to trace amounts. B. H.



**n (Charles), Axelrod (J. M.), Carron (M. K.), & MacNeil (F. S.).** *Gorceixite from Dale County, Alabama.* Amer. Min., 1958, **43**, 688–694, 3 figs., 3 tables.

Gorceixite from Alabama is found as irregular nodules several inches across in an Eocene marl. The origin of these nodules is an unsolved problem. Four chemical analyses are given. Two specimens have compositions approximating  $RAl_3(PO_4)_2(F,OH)_5(H_2O)_3$  and  $R_{0.8}Al_{4.6}(F,OH)_{10}(H_2O)_{0.3}$ ; both have an X-ray diffraction pattern of the alunite–plumbogummite–beudanticite group. The mineral is isotropic with  $n$  about 1.61, sp. gr. about 4.0. No explanation is offered for the differences in composition; other recorded analyses of similar minerals show large differences.

B. H. B.

**mi (K.) & Otsuka (H.).** *Powellite from the Kokurobé mine, Toyama Prefecture.* Journ. Min. Soc. Japan, 1957, **3**, 234–235 (in Japanese).

Light green powellite with light yellow fluorescence occurs in the Kokurobé molybdenum mine as an earthy mineral, isomorphous after molybdenite. Its chemical composition:  $MoO_3$  69.7,  $WO_3$  1.5,  $FeO$  1.2,  $CaO$  26.0,  $MgO$  0.1,  $SiO_2$  0.1,  $Al_2O_3$  0.3,  $H_2O$  1.8,  $Fe_2O_3$  29.3,  $As_2O_3$  0.08,  $H_2O$  1.8, = 99.7. The X-ray powder pattern is compared with those of scheelite and artificial  $CaMoO_4$ .

R. A. H.

**on (Charles), Axelrod (J. M.), & Ingram (Blanche).** *Bismutoferrite, chapmanite, and "hypochlorite".* Amer. Min., 1958, **43**, 656–670, 1 fig., 7 tables.

Bismutoferrite gives a unique X-ray diffraction pattern and a consistent chemical analysis,  $Bi(OH)Fe_2(SiO_4)_2$ , so is considered a valid mineral species. A new analysis by Blanche Ingram gives  $Bi_2O_3$  42.5,  $Al_2O_3$  0.3,  $SiO_2$  23.9,  $Fe_2O_3$  29.3,  $As_2O_3$  0.08,  $H_2O$  1.8, = 99.7. The refractive indices are  $\alpha$  1.93,  $\beta$  1.97,  $\gamma$  2.01; sp. gr. 4.47 (Zenzel, 1871). Evaluation of existing chemical analyses and comparison of X-ray diffraction patterns establish chapmanite as the antimony analogue of bismutoferrite. The refractive indices of chapmanite [M.A. 2–336] are  $\alpha$  1.85,  $\gamma$  1.96, sp. gr. 3.58. Bismutoferrite and chapmanite therefore form a homologous and presumably isostructural group of valid species. 'Hypochlorite' is a name designating either mineral or their admixture dispersed in quartz; it is well be discarded.

B. H. B.

**kanabe (T.) & Kato (A.).** *A new occurrence of pyrosmalite in the Kyurazawa mine, Tochigi Prefecture, Japan.* Min. Journ. [Japan], 1957, **3**, 180–186, 2 pls.

Pyrosmalite occurs as an important ore-forming mineral

at the Kyurazawa mine. Tabular or prismatic crystals in vugs in the coarse granular pyrosmalite and knebelite had  $a$  13.04,  $c$  7.135 Å; perfect basal cleavage;  $\epsilon$  1.639,  $\omega$  1.671; sp. gr. 3.14. The associated knebelite had  $a$  4.86,  $b$  10.58,  $c$  6.16 Å; indexed X-ray powder data are tabulated for both minerals, and for knebelite from Dannemora, Sweden. [M.M. 31–371; M.A. 12–236, 13–374, 540] R. A. H.

**Henmi (K.).** *Natural occurrences of zeunerite.* Min. Journ. [Japan], 1957, **2**, 134–137.

Zeunerite (as opposed to metazeunerite) has been identified in the lepidomelane zone of the Suisho-yama pegmatite, Kawamata, Fukushima Prefecture, and in a humid gallery of the Miyoshi tungsten mine, Kurashiki City, Okayama Prefecture, where it is accompanied by other secondary copper and arsenic minerals and has the forms {001}, {110}, {011}, {013} and {112} (these indices being based on the axial ratio  $c/a$  2.89 as determined by X-ray methods). The Suisho-yama zeunerite has  $\epsilon$  1.59,  $\omega$  1.611, the Miyoshi material has  $\epsilon$  1.589,  $\omega$  1.612, and both have  $\epsilon$  nearly colourless,  $\omega$  yellowish green. The X-ray powder data are tabulated for both specimens and for torbernite from Kurayoshi, Tottori Prefecture: the Suisho-yama zeunerite has  $a$  7.19,  $c$  20.7 Å. [M.M. 30–351; M.A. 11–323, 12–281, 13–634] R. A. H.

**Fujiwara (T.).** *Chlorite in the so-called propylite of the Yugashima mine.* Journ. Min. Soc. Japan, 1957, **3**, 209–213.

The optical character, chemical composition and X-ray powder pattern of the chlorite in propylite of the Yugashima series indicate it as a ripidolite with structural formula  $(Mg_{2.6}Fe^{2+}_{1.4}Fe^{3+}_{0.4}Al_{0.8})(Si_{2.6}Al_{1.4})O_{10}(OH)_8$ . R. A. H.

**Honda (S.).** *Glaucanite from the Oga Peninsula, Akita Prefecture.* Journ. Min. Soc. Japan, 1957, **3**, 124–129.

Glaucanite granules from a borehole core, east of Ichinomé-gata, Oga Peninsula, Akita Prefecture, Japan, had sp. gr. 2.52, mean refr. ind. 1.605. Chemical analysis gave  $SiO_2$  49.30,  $Al_2O_3$  5.13,  $Fe_2O_3$  18.78,  $FeO$  2.31,  $CaO$  0.59,  $MgO$  3.54,  $K_2O + Na_2O$  5.78, ign. loss 6.14,  $H_2O$  8.51, = '100.18'. The d.t.a. curve has endothermic peaks at 150°, 510°, and 940°C.

R. A. H.

**Sudo (T.) & Hayashi (H.).** *Diaspore found in association with zincblende and pyrite ores of the Hanaoka mine, Akita Prefecture.* Min. Journ. [Japan], 1957, **2**, 187–192, 1 fig.

Diaspore occurs as short prismatic crystals with  $\alpha$

1.685–1.690,  $\gamma$  1.730–1.737,  $2V_\gamma$   $84^\circ$ – $86^\circ$ . The X-ray powder data are tabulated: the d.t.a. curve has a strong endothermic peak between  $500^\circ$  and  $600^\circ\text{C}$ . R. A. H.

**Kodama (H.).** *Sericite from Ozawa-Mura, Gumma Prefecture.*

Min. Journ. [Japan], 1957, **2**, 151–161, 3 figs., 1 pl.

Sericite from the Yoji pass, Ozawa-Mura, Kanra-gun, Gumma Prefecture, occurs as an irregular mass associated with a quartz-diorite intruded into argillaceous rocks and has sp. gr. 2.87;  $d_{060}$   $1.501\text{\AA}$ ; with d.t.a. endothermic peaks at  $635^\circ$  and  $980^\circ\text{C}$ . A chemical analysis by H. Kodama gave  $\text{SiO}_2$  47.65,  $\text{TiO}_2$  0.10,  $\text{Al}_2\text{O}_3$  37.03,  $\text{Fe}_2\text{O}_3$  0.01, FeO tr., MnO tr., MgO 0.04, CaO tr.,  $\text{K}_2\text{O}$  9.02,  $\text{Na}_2\text{O}$  0.76,  $\text{H}_2\text{O} + 4.97$ ,  $\text{H}_2\text{O} - 0.73$ ,  $\text{P}_2\text{O}_5$  0.02, = 100.33. Indexed X-ray powder data are tabulated for the sericite, and study of a pre-heated specimen showed that its structure was destroyed at about  $1000^\circ\text{C}$  leading to the formation of mullite.

R. A. H.

**Ukai (Y.), Nishimura (S.), & Hashimoto (Y.).** *Chemical studies of lithium micas from the pegmatite of Minagi, Okayama Prefecture.* Min. Journ. [Japan], 1956, **2**, 27–38, 4 figs.

A pegmatite in metamorphosed argillaceous rocks of Palaeozoic age with nearby acid igneous rocks is shown to have the five zones—border, biotite, muscovite, zinnwaldite, and lepidolite—arranged inwards successively, each zone being characterized chiefly by the variety of mica. Chemical analyses are given of averaged material of the feldspars in each zone and of the biotite (A) from the biotite zone, muscovite (B) from the muscovite zone, zinnwaldite (C) from the zinnwaldite zone, lepidolite (D) from the lepidolite zone, together with those of further lepidolite (E) and zinnwaldite (F) from this pegmatite. The crystallochemical behaviour of lithium in the pegmatite is discussed.

	$\text{SiO}_2$	$\text{TiO}_2$	$\text{Al}_2\text{O}_3$	$\text{Fe}_2\text{O}_3$	FeO	MnO	MgO	CaO	$\text{Li}_2\text{O}$
A	37.71	0.54	15.30	2.91	24.55	1.07	1.65	1.50	1.55
B	45.80	tr.	21.21	2.78	6.18	4.80	0.57	0.72	2.59
C	38.78	0.17	8.84	19.61	5.00	2.91	0.54	0.54	3.30
D	51.37	tr.	21.61	—	0.90	2.05	0.49	0.68	4.99
E	50.83	tr.	23.70	—	1.24	0.97	0.46	0.24	5.51
F	39.03	tr.	19.57	1.40	4.58	3.86	4.75	8.13	2.92

	$\text{Na}_2\text{O}$	$\text{K}_2\text{O}$	$(\text{Rb}, \text{Cs})_2\text{O}$	F	$\text{H}_2\text{O} +$	$\text{H}_2\text{O} -$	$\text{O} \equiv \text{F}$	Total
A	0.64	6.29	0.58	5.00	0.91	2.20	2.11	100.29
B	1.29	8.89	2.04	5.78	0.44	0.38	2.43	101.04
C	1.06	10.34	3.29	6.40	1.30	0.54	2.69	'100.31'
D	0.47	11.99	0.76	6.72	0.70	0.30	2.83	100.20
E	1.06	9.88	1.64	6.96	0.90	0.12	2.93	100.58
F	0.46	7.91	1.00	5.19	2.49	1.06	2.19	100.16

R. A. H.

[Ginzburg (A. I.) Гинзбург (А. И.). Битиит — литий бериллиевый маргарит. [Bityite — lithium-beryll margarite.] Труды Минер. Муз. Акад. Наук СССР [Trans. Min. Mus. Acad. Sci. U.S.S.R.], 1957, 128–131.

The comparison of chemical and optical data suggests that bityite and bowleyite are identical minerals and correspond to a lithium-beryllium margarite the formula of which is  $\text{CaLi}_{n-m}\text{Al}_2[\text{Si}_2\text{Al}_{2-n}\text{Be}_n\text{O}_{10-m}(\text{OH})_m](\text{OH})_m$  with  $n=1$  and  $m=0$  this formula gains its ideal form. The name bowleyite is unnecessary. [M.M. 28–725; M. 10–508] S. I. T.

**Gower (John Arthur).** *X-ray measurement of the iron-magnesium ratio in biotites.* Amer. Journ. Sci., 1957, **255**, 142–156, 7 figs.

The iron-magnesium ratio in biotite may be determined by measuring the intensity ratio of the 004 to 005 X-ray powder diffraction basal reflections. This ratio is highly sensitive to Fe/Mg substitution and appears to be accurate to about 5% of the Fe+Mg content: it is virtually unaffected by other substitutions such as Na for K, F for OH, and Al for Si. Investigation of the variation in unit cell parameters indicates that these are of limited value in determining composition. Fe-rich biotites are found to have a smaller  $c$  parameter than Mg members, despite the larger ionic radius of  $\text{Fe}^{2+}$ : F produces a marked decrease in  $c$ , tetrahedrally coordinated Al may cause a slight increase. The  $b$  parameter shows little change with varying Fe/Mg ratios but is reduced in fluorine-rich specimens. The  $a$  parameter shows a similar trend. A triangular variation diagram plotting Fe, Mg, and octahedral Al indicates more extensive solid solution with muscovite than previously supposed. The relationship of physical properties and composition to paragenesis is discussed. Some metamorphic biotites have a larger  $d_{100}$  spacing than their igneous counterparts. New analyses given include phlogopite (A), west of Dent, Clearwater County, Idaho; biotite (B), Miask, Urals; and siderophyllite (C), Brooks Mountain, Alaska.

	$\text{SiO}_2$	$\text{TiO}_2$	$\text{Al}_2\text{O}_3$	$\text{Fe}_2\text{O}_3$	FeO	MnO	MgO	CaO	$\text{Na}_2\text{O}$
A	42.19	0.61	12.60	0.33	2.91	0.02	25.61	0.06	0.31
B	33.07	3.84	16.32	5.97	22.46	—	5.85	0.26	0.87
C	37.01	0.02	15.89	tr.	30.16	1.01	0.22	0.10	0.58

	$\text{K}_2\text{O}$	F	$\text{H}_2\text{O} +$	$\text{H}_2\text{O} -$	Less $\text{O} \equiv \text{F}$	Total	$a$	$b$	$c$ sin
A	9.91	2.66	2.84	0.33	1.12	99.39	5.23	9.235	10.07
B	7.92	—	3.87	—	—	100.43	—	9.250	10.04
C	9.02	3.88	1.02	—	1.68	99.69	—	9.239	10.02

A has also  $\text{P}_2\text{O}_5$  0.13; C has also  $\text{Li}_2\text{O}$  0.01,  $\text{Rb}_2\text{O}$  0.19,  $\text{Cs}_2\text{O}$  0.12, Cl 0.24.

[M.A. 8–161, 10–73, 271, 12–534]

R. A. H.



**kov (N. P.)**] Старков (Н. П.). Хлорит из кварцевых жил плато Кваркуш на Урале. [*Chlorite from quartz veins of the plateau Kvarakush in the Urals*]. Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1957, **86**, 505–508, 3 figs.

micular crystals of chlorite embedded in quartz are described: dark green in colour,  $\alpha$  1.628,  $\gamma$  1.632, 2V(+) 8°. Chemical analysis gave SiO<sub>2</sub> 26.65, Al<sub>2</sub>O<sub>3</sub> 23.80, Fe<sub>2</sub>O<sub>3</sub> 21.22, MnO 0.43, NiO trace, MgO 16.28, CaO 0.36, K<sub>2</sub>O 9.33, H<sub>2</sub>O— 1.64, TiO<sub>2</sub> abs., = '100.64'. Microthermal analysis proved two endothermal effects at 550–630°C and 780°C, and one exothermal effect at 850°C. The mineral belongs to the group of prochlorites, according to the classification of D. P. Serdyuchenko. S. I. T.

**arov (P. P.)**] Назаров (П. П.). Фуксит из Кривого Рога. [*Fuchsite from Krivoy Rog*]. Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1957, **86**, 502–505, 2 figs.

Fuchsite, from a fuchsite vein, on analysis gave SiO<sub>2</sub> 60, Al<sub>2</sub>O<sub>3</sub> 31.75, Cr<sub>2</sub>O<sub>3</sub> 1.12, Fe<sub>2</sub>O<sub>3</sub> 1.66, FeO 0.35, MgO 0.06, CaO 0.06, K<sub>2</sub>O 9.84, F abs., ign. loss 4.56, TiO<sub>2</sub> 0.65, = 115;  $\alpha$  1.5985,  $\beta$  1.6045, 2V(–) 45°. Comparison of data for fuchsite shows a definite relation existing between the amounts of Cr<sub>2</sub>O<sub>3</sub>+Fe<sub>2</sub>O<sub>3</sub> and optical properties of the mineral. S. I. T.

**keev (M. R.)**] Еникеев (М. Р.). Редкая находка нитрокальцита. [*A rare find of nitrocalcite*]. Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1957, **86**, 403–404, 1 fig.

Nitrocalcite is found among the incrustations forming during dry seasons on the limestone in the old mines, containing a large accumulation of animal dung, at Altyn-Khan, Kuramin Mts. in Central Asia. Nitrocalcite is a rare mineral with  $\omega$  1.514,  $\epsilon$  1.522. Analysis gave CaO 60, MgO 0.72, N<sub>2</sub>O<sub>5</sub> 46.00, H<sub>2</sub>O 30.50, = 100.02 corresponding to Ca(NO<sub>3</sub>)<sub>2</sub>·4H<sub>2</sub>O. The heating curve shows two stops, at 240° and 640°C. S. I. T.

**Ionova (T. G.)**] Радонова (Т. Г.). О гидрослюдистом минерале из Родопских гор. [*On a hydromica mineral from the Rodope mountains*]. Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1958, ser. 2, **87**, 224–230, 5 figs.

A green, chlorite-like, mineral found in a sulphide-bearing quartz vein of Mazharovo, Bulgaria, is described. It occurs

in the form of scaly and fibrous aggregates,  $\alpha$  1.567–1.569,  $\gamma$  1.586–1.589, pleochroic. Chemical analysis gave SiO<sub>2</sub> 37.68, TiO<sub>2</sub> tr., Al<sub>2</sub>O<sub>3</sub> 22.04, Fe<sub>2</sub>O<sub>3</sub> 7.28, FeO 10.06, MgO 8.40, CaO abs., MnO 0.44, Na<sub>2</sub>O 0.10, K<sub>2</sub>O 0.77, H<sub>2</sub>O+ 10.02, H<sub>2</sub>O— 2.76, = 99.55. The heating curve shows 75°–125° and 510°–550°C endothermal and 810°–860°C exothermal stops. Spectroscopic and X-ray data are also given. S. I. T.

**[Soloviev (A. T.) & Levando (E. P.)]** Соловьев (А. Т.) и Левандо (Е. П.). Геарксутит из восточного Забайкалья. [*Gearksutite from eastern Transbaikalia*]. Доклады Акад. Наук СССР [C. R. Acad. Sci. U.S.S.R.], 1958, **119**, 158–160, 4 figs.

A white kaolinite-like mineral from the Kalangui fluorite deposit is described. It occurs as a fine-grained aggregate,  $\alpha$  1.451,  $\gamma$  1.460, 2V very small, elongation positive. Chemical analysis gave SiO<sub>2</sub> 0.50, TiO<sub>2</sub> trace, Al<sub>2</sub>O<sub>3</sub> 29.87, Fe<sub>2</sub>O<sub>3</sub> 0.08, MgO 0.18, CaO 31.34, P<sub>2</sub>O<sub>5</sub> 0.03, F 39.10, Cl trace, H<sub>2</sub>O— 0.19, ign. loss 15.68 (reduced to H<sub>2</sub>O 14.81), corresponding to CaAl(F,OH)<sub>5</sub>. The heating curve shows three endothermal stops at 398°, 523° and 898°C. S. I. T.

**[Eliseev (E. N.)]** Елисеев (Е. Н.). Рентгенометрическое изучение минералов изоморфного ряда форстерит-фаялит. [*X-ray study of the minerals of the isomorphous series forsterite-fayalite*]. Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1957, **86**, 657–670, 3 figs.

This work is based on thirteen samples of olivines ranging from forsterite to fayalite. Chemical analyses are given for six samples, and X-ray and optical data for all. The results of this study show that with increase of the fayalite component there is a progressive increase in the interplanar distances and in the unit cell parameters. S. I. T.

**[Sosedko (A. F.) & Gordienko (V. V.)]** Соседко (А. Ф.) и Гордиенко (В. В.). Эвкрипит из пегматита северной части Кольского полуострова. [*Eucryptite from a pegmatite in the northern part of the Kola peninsula*]. Доклады Акад. Наук СССР [C. R. Acad. Sci. U.S.S.R.], 1957, **116**, 135–136, 1 pl.

In one of the pegmatite dykes of Kola peninsula spodumene in places shows a transition into a compact substance externally resembling chalcedony. Under the microscope, this substance consists of a cryptocrystalline aggregate of eucryptite and albite, on which eucryptite appears in stellate grains. On analysis eucryptite gave SiO<sub>2</sub> 54.11,

TiO<sub>2</sub> 0.03, Al<sub>2</sub>O<sub>3</sub> 30.68, Fe<sub>2</sub>O<sub>3</sub> 0.41, MnO 0.04, MgO 0.16, CaO 0.10, Na<sub>2</sub>O 3.80, K<sub>2</sub>O 1.47, Li<sub>2</sub>O 6.14, H<sub>2</sub>O+ 1.75, H<sub>2</sub>O— 0.40, ign. loss 0.40, =99.49. The dominant X-ray lines are 3.96, 3.41, 2.729, 2.368, 1.7940, 1.370, 1.292Å;  $\omega$  1.570,  $\epsilon$  1.585. S. I. T.

[Ginzburg (I. V.), Rogachev (D. L.), & Bondareva (A. M.)]

Гинзбург (И. В.), Рогачев (Д. Л.) и Бондарева (А. М.). Новые данные о гольмквистите. [New data on holmquistite]. Доклады Акад. Наук СССР [C. R. Acad. Sci. U.S.S.R.], 1958, **119**, 1013–1016, 1 fig.

Holmquistite is found in the contact zone of spodumene pegmatite with anorthosite and amphibolite. It occurs as long prismatic crystals of violet colour, in cross section—light violet with a pinkish tinge, in longitudinal section—dark violet with a bluish tinge. Pleochroic  $a \parallel \alpha$  1.624 (light greyish-yellow),  $b \parallel \beta$  1.645 (pinkish-violet),  $c \parallel \gamma$  1.651 (dark bluish-violet),  $2V_{\alpha}$  50°. Chemical analysis gave SiO<sub>2</sub> 58.72, TiO<sub>2</sub> 0.05, Al<sub>2</sub>O<sub>3</sub> 13.01, Fe<sub>2</sub>O<sub>3</sub> 2.24, FeO 8.94, MnO 0.19, MgO 9.43, CaO 1.00, Li<sub>2</sub>O 2.43, Na<sub>2</sub>O 0.23, K<sub>2</sub>O abs., CO<sub>2</sub> 1.54, F 0.14, H<sub>2</sub>O+ 1.87, H<sub>2</sub>O— 0.12, =99.91—O for F<sub>2</sub> 0.06 = 99.85. X-ray data,  $a$  18.27,  $b$  17.17,  $c$  5.30Å. Diffraction symbol  $mmmPna$ , which includes two space groups,  $D_{2h}^{16} = Pnma$  and  $C_{2v}^9 = Pna2$ . It belongs definitely to the orthorhombic and not to the monoclinic system. [M.A. 14–53] S. I. T.

[Sosedko (T. A.)] Соседко (Т. А.). Изменение структуры и свойств в бериллах с повышенным содержанием щелочей. [The change of structure and properties of beryls with increasing amounts of alkalis]. Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1957, **86**, 495–499, 1 fig.

Three samples of beryls from a pegmatite vein connected with granite [locality?] are studied.

	Zone of vein	Colour	Sp. gr.	$\omega$	$\epsilon$
A	Contact	Green	2.72	1.580	1.574
B	Intermediate	Milky white	2.75	1.587	1.581
C	Inner	Pink	2.78	1.592	1.586

	Unit cell			SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	BeO	MnO
	$a$	$c$	$c/a$					
A	9.202	9.183	0.9979	65.32	17.77	0.13	12.60	trace
B	9.202	9.209	1.0008	64.17	17.42	0.12	11.82	abs.
C	9.200	9.227	1.0030	61.88	17.10	0.08	10.54	trace

	MgO	CaO	Na <sub>2</sub> O	K <sub>2</sub> O	Li <sub>2</sub> O	Cs <sub>2</sub> O	ign. loss	H <sub>2</sub> O—	Ti <sub>2</sub> O	Total
A	0.25	0.26	1.27	—	0.30	0.27	1.76	0.08	0.01	100.02
B	0.21	0.44	1.39	—	1.23	0.67	1.88	0.60	0.01	99.96
C	0.22	0.44	2.50	—	0.60	4.13	2.26	0.16	0.01	99.92

S. I. T.

[Serdyuchenko (D. P.) & Kadensky (A. A.)] Сердюченко (Д. П.) и Каденский (А. А.). Ксонотлиты и пектолиты кавказских и других месторождений. [Xonotlites and pectolites of Caucasian and other localities]. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1958, **87**, 31–47, 6 figs.

This is a chemical, optical, X-ray, and thermal study of pectolite and xonotlite from various northern Caucasian localities followed by a general review of the recent work on these two minerals. S. I. T.

[Ontoev (D. O.)] Онтоев (Д. О.). Хлорсодержащие минералы — скаполит и дашкесанит — из Хавуаксинского месторождения (Тува). [Chlorine-containing minerals — scapolite and dashkesanite — from the Khavakhsin deposit (Tuva)]. Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1958, **87**, 48–54, 6 figs.

Scapolite and dashkesanite [M.A. 6–438] are found in skarns adjoining nickel and cobalt arsenide carbonate veins. Chemical analyses and optical properties of these minerals are given and their genesis and paragenesis are discussed. S. I. T.

[Chukhrov (F. V.), Moleva (V. A.), & Ermilova (L. I.)] Чухров (Ф. В.), Молева (В. А.) и Ермилова (Л. И.). Новые данные о митридатите. [New data on mitridatite]. Изв. Акад. Наук СССР, Сер. Геол. [Bull. Acad. Sci. URSS, Sér. Géol.], 1958, no. **8**, 16–19, 3 figs.

Chemical, X-ray, electronographic, electronmicroscopic and thermal studies show that mitridatite is a metacolloidal mineral containing a certain amount of colloidal material. It is monoclinic or triclinic,  $n$  1.77, tobacco-green to dark green, compact or earthy; Ca<sub>2</sub>Fe<sub>3</sub>[(PO<sub>4</sub>)<sub>3</sub>(OH)<sub>4</sub>].nH<sub>2</sub>O with  $n$  1. It is formed either directly from solution or as an alteration product of oxykerchenite or anapaite. [M.A. 7–60, 10–11] S. I. T.

[Nefedov (E. I.)] Нефедов (Е. И.). Новые данные о бисмутите. [New data on bismutite]. Информационный Сборник Госгеолтехиздат. [Information Mag., Gosgeoltekhisdat], 1956, no. **3**, 80–82.

Crystals of bismutite are found in a pegmatite vein in the north-western part of the Karelo-Finnish S.S.R. X-ray study proves a tetragonal unit cell with  $a$  3.86,  $c$  13.66Å, but the optics are those of an orthorhombic mineral with the  $a$  and  $b$  axes the diagonals of the 'tetragonal' cell.



ly biaxial,  $\alpha(=c)$  2.30,  $\beta$  2.36,  $\gamma$  2.38,  $2V_\gamma$  45°; twinned on (110) or as chess-board quadruplets.

S. I. T.

**Ch (Joseph).** *Crystallography and X-ray measurements of howlite from California.* Amer. Min., 1957, **2**, 521–524.

ular crystals of howlite,  $H_5Ca_2SiB_5O_{14}$ , up to 1 mm have been found on massive material at the Sterling mine, Tick Canyon, California. They are mono- with {100} dominant, {001} and {011} well developed; prismatic faces in the orthodome zone such as {104} or {110} are poorly represented. Weissenberg rotation and line photographs gave  $a$  12.93,  $b$  9.34,  $c$  8.60,  $\beta$  104° space group  $P2_1/c(C_{2h}^5)$  the indexed X-ray powder data are listed.

R. A. H.

**Muswami (T. N.).** *Clinohumite, Sausar series, Bhandara District, India.* Proc. Indian Acad. Sci., 1958, **48A**, 1–28, 1 fig., 1 pl.

Clinohumite occurs in a dolomitic marble of the Sausar group of Archean age in Madhya Pradesh, associated with calcite, phlogopite, tremolite, and spinel. Material from such marble near Baoli, on the Bhawanthari river, 15 miles north-east of Deolapar, had  $\alpha$  (golden yellow) 1.658,  $\beta$  (pale yellow) 1.658,  $\gamma$  (pale yellow) 1.670,  $2V_\gamma$  76°,  $2\phi=9^\circ$ ; sp. gr. 3.23,  $H$ . 5½–6; both simple and poly- met twinning on {001}; cleavage poor. Chemical analysis by J. Ito gave  $SiO_2$  37.18,  $TiO_2$  2.92,  $Fe_2O_3$  0.49,  $MnO$  0.04,  $MgO$  55.09,  $F$  0.95,  $H_2O+1.30$ ,  $H_2O-0.40=100.06$ . X-ray powder pattern data are listed and a discussion on the role of Ti in the structure is accompanied by a review of many clinohumite analyses

and the tabulation of the optical and physical properties of many clinohumites, humites, and chondrodites.

R. A. H.

**Lee (D. E.).** *An andradite-spessartite garnet from Pajsberg, Sweden.* Amer. Min., 1958, **43**, 208–215, 3 tables.

A specimen of fine-grained rock from the Pajsberg Mine contains chiefly garnet, clinopyroxene, and rhodonite. The garnet has the composition  $SiO_2$  34.8,  $Al_2O_3$  8.0,  $Fe_2O_3$  22.0,  $FeO$  0.5,  $MnO$  11.4,  $MgO$  0.1,  $CaO$  22.9,  $H_2O+0.03$ ,  $TiO_2$  0.06,  $BaO$  nil, =99.8, equivalent to mol. % andradite 66, spessartite 27, almandine 4, grossular 2, and pyrope 1. Other data are: sp. gr. 3.96–4.00,  $n$  1.888–1.898, unit cell  $11.99 \pm 0.02 \text{ \AA}$ . A second Pajsberg garnet sample of average sp. gr. 4.05 contained 14.6% MnO. Natural andradite may contain as much as 34% spessartite. The clinopyroxene has  $\alpha$  1.727,  $\beta$  1.740,  $\gamma$  1.756, all  $\pm 0.004$ ;  $v>r$  moderate; sp. gr. 3.45–3.49; the composition is not known. The rhodonite has  $\alpha$  1.724,  $\beta$  1.730,  $\gamma$  1.738, all  $\pm 0.004$ , sp. gr. 3.61–3.64.

B. H. B.

**Hurlbut (C. S.).** *Additional data on bikitaite.* Amer. Min., 1958, **43**, 768–770, 2 figs., 1 table.

A new specimen of bikitaite ( $LiAlSi_2O_6 \cdot H_2O$ ) from Southern Rhodesia afforded good crystals suitable for goniometric measurement. The crystals are elongated on [010] with  $c$  {001} and  $t$  {101} the dominant forms; other forms present are  $b$  {010},  $a$  {100},  $m$  {110},  $n$  {210},  $s$  {102},  $o$  {112}. They are monoclinic with  $a:b:c = 1.7434:1:1.5434$ ,  $\beta$  114° 34'; sp. gr. redetermined as 2.29. [A.M. 42–792–797; M.M. 31–954; M.A. 13–661.]

B. H. B.

## NEW MINERALS

**Atso (Atso).** *Laitakarite—a new Bi-Se mineral from Orijärvi.* Geologi (Helsinki), 1959, **11**, no. 2, 11. (In Finnish).

In 1932 Prof. Aarne Laitakari collected from the, at that time, new shaft of the Orijärvi mine, South Finland, a small amount of Bi-minerals and among them he thought guanoite was present. His material has now been re-examined by Vorma who has found that it contains a new Bi-Se-mineral, the composition of which is  $Bi_8(Se,S)_7$ —ratio S:Se being approx. 2. According to the powder diagram, the new mineral has the same reflections as guanoite. It is rhombohedral with  $a$  4.225,  $c$  39.93 Å, thus

also in this respect identical with jositite, but contains over 16% Se, instead of approx. 1% or a little more in jositite. The new mineral is very soft, H. 2, and forms scales parallel to (0001). Under the microscope it is white, somewhat grayish as compared with native bismuth. It is weakly pleochroic and anisotropic; sp. gr. 7.93. The new mineral was named, in the honour of the discoverer of the material from which it was disclosed, *laitakarite*, and it is supposed to be isomorphous with jositite. The formula given above is based on the analysis published by Laitakari. A full report on the new mineral is expected.

V. M.

**Blix (R.), Gabrielson (O.), & Wickman (F. E.).** *Jagoite, a new lead-silicate mineral from Långban in Sweden.* Arkiv Min. Geol. Stockholm, 1957, **2**, 315-317.

*Jagoite*, named in honour of J. B. Jago, San Francisco, is a yellow-green hexagonal mineral from the Långban mine. Chemical analysis  $\text{SiO}_2$  22.35,  $\text{Al}_2\text{O}_3$  0.50,  $\text{Fe}_2\text{O}_3$  7.00, FeO nil, MgO 0.60, CaO 0.65,  $\text{Na}_2\text{O}$  0.61,  $\text{K}_2\text{O}$  0.37,  $\text{H}_2\text{O} +$  0.17,  $\text{H}_2\text{O} -$  0.19,  $\text{TiO}_2$  0.10, BeO 0.12, MnO 0.88, PbO 64.26, Cl 3.25, F nil, less 0 for Cl 0.73, = 100.32. Calculated formula  $(\text{Pb,Ca,Mn,Na,K})_{24}(\text{Fe}^{3+},\text{Al,Mg})_8(\text{Si,Al,Be})_{27}\text{O}_{84}(\text{OH,Cl})_8$ . It occurs as fine-grained micaceous aggregates on hematite ore together with melanotekite, quartz, and a mixture of a mineral not yet identified and quartz. The probable space groups are  $P3$  and  $P\bar{3}$  with unit cell lengths  $a$   $8.65 \pm 0.03$ ,  $c$   $33.5 \pm 0.1 \text{ \AA}$  (powder data). *Jagoite* has a perfect basal cleavage and a hardness of 3; sp. gr. 5.43; optically negative, refr. ind. around 2.0; it is nonpleochroic with a birefringence of 0.025. [M.M. 31-962; A.M. 43-387]

E. W.

**Mountain (E. D.).** *Rhodesite, a new mineral from the Bultfontein mine, Kimberley.* Min. Mag., **31**, 607-610; author's abstract, Min. Abstr. 13-555.

The specimen is a mass of silky, white fibres with subradiate structure; H. for the mass about 4; sp. gr. about 2.36; fusible to a clear glass; gives alkaline reaction with hot water, decomposed by conc. HCl, leaving silica gel;  $\alpha$  1.502,  $\beta$  1.506 approx.,  $\gamma$  1.515; average of two analyses,  $\text{SiO}_2$  61.83,  $\text{Al}_2\text{O}_3$  0.29, FeO 0.25, CaO 14.90, MgO 0.08,  $\text{Na}_2\text{O}$  4.93,  $\text{K}_2\text{O}$  5.28,  $\text{H}_2\text{O}$  12.50, = 100.06, tests suggest CaO can reach 18%, with correspondingly low alkalis, formula approx.  $4(\text{Ca,Na}_2,\text{K}_2)\text{O} \cdot 10\text{SiO}_2 \cdot 7\text{H}_2\text{O}$ . Results of heating tests are stated. The mineral is named after C. J. Rhodes and Rhodes University, Grahamstown. [M.M. 31-971; A.M. 43-624. See also following abstract.]

J. Ph.

**Gard (J. A.) & Taylor (H. F. W.).** *An investigation of two new minerals: rhodesite and mountainite.* Min. Mag., 1957, **31**, 611-623, 6 figs., 4 tables.

In some specimens of rhodesite [see previous abstract] another new mineral is present; this has been named *mountainite* after Prof. E. D. Mountain. In the investigation the following data for rhodesite were obtained: fibres  $\parallel c$ , cleavage good  $\parallel (100)$ ; extinction  $\parallel c$ , elongation +,  $\alpha$  1.502,  $\beta$  1.505,  $\gamma$  1.515;  $\alpha \parallel b$ ,  $\beta \parallel a$ , 2V low, +; orthorhombic,  $a$  23.8,  $b$  6.54,  $c$  7.05  $\text{\AA}$ ,  $\beta$  90°, cell contents  $(\text{Ca,Na}_2,\text{K}_2)_8\text{Si}_{16}\text{O}_{40} \cdot 11\text{H}_2\text{O}$ . A new chem. anal. by R. A.

Chalmers gave  $\text{SiO}_2$  61.6,  $\text{Al}_2\text{O}_3$  nil, FeO nil, CaO nil, MgO nil,  $\text{Na}_2\text{O}$  5.2,  $\text{K}_2\text{O}$  6.0, ign. loss (mainly  $\text{H}_2\text{O}$ ), include a little  $\text{CO}_2$  12.3, = 100.2; sp. gr. 2.36. X-ray powder data are tabulated.

*Mountainite* is similar in appearance and optical properties to rhodesite: length of fibres  $\parallel b$ , one doubtful cleavage in the prism zone; extinction  $\parallel$  fibre, elongation  $\pm$ ,  $\alpha$  1.510,  $\beta$  1.510,  $\gamma$  1.519 on polycrystalline fibres so that true  $\alpha$  probably lower, true  $\gamma$  probably higher,  $b = \beta$ , 2V moderate or high, probably +; monoclinic  $a$  13.51,  $b$  13.10,  $c$  13.4,  $\beta$  104°, cell contents  $(\text{Ca,Na}_2,\text{K}_2)_{16}\text{Si}_{32}\text{O}_{80} \cdot 24\text{H}_2\text{O}$ . These values are the most probable ones but the true value of  $b$  may be 6.55  $\text{\AA}$ . Chem. anal. by R. A. Chalmers gave  $\text{SiO}_2$  58.5,  $\text{Al}_2\text{O}_3$  nil, FeO n.d., CaO 13.4, MgO 0.2, MnO 7.9,  $\text{K}_2\text{O}$  6.0,  $\text{H}_2\text{O}$  13.4, = 99.4; sp. gr. 2.36. X-ray powder data are tabulated. D.t.a. curves determined by R. C. Mackenzie and electron-micrographs and electron diffraction patterns of the two new minerals are figured. The new minerals are similar to the fibrous zeolites, but resemble thomsonite and gonnardite in habit and optical properties; their d.t.a. curves differ markedly from that of thomsonite. [M.M. 31-967; A.M. 43-624] J. Ph.

**Sahama (Th. G.) & Hytönen (K.).** *Kirschsteinite, a new mineral, an analogue to synthetic iron monticellite, from the Belg Congo.* Min. Mag., **31**, 698-699.

From the same nephelinite specimen, from Mt. Shabwa, North Kivu, in which the new minerals götzenite and combeite were discovered [M.M. 31-503; M.A. 14-100, A.M. 43-790, 791] another new mineral, named *kirschsteinite* after the German geologist Egon Kirschstein, was described. For material separated by heavy liquids and magnetic separator the data are as follows: colourless, thin section,  $\alpha$  1.689,  $\beta$  1.720,  $\gamma$  1.728,  $\gamma - \alpha$  0.039 (calc.), 2V $\alpha$  51°  $\pm$  1° (universal stage), 53° (calc.);  $a = \gamma$ ,  $b = c = \beta$ ;  $a$  4.859,  $b$  11.132,  $c$  6.420  $\text{\AA}$ ; chem. anal.  $\text{SiO}_2$  32.2,  $\text{Al}_2\text{O}_3$  0.26,  $\text{Fe}_2\text{O}_3$  0.66, FeO 29.34, MnO 1.65, MgO 4.4, CaO 29.30,  $\text{Na}_2\text{O}$  0.34,  $\text{K}_2\text{O}$  0.36,  $\text{H}_2\text{O} +$  0.25,  $\text{H}_2\text{O} -$  0.25,  $\text{TiO}_2$  0.23,  $\text{P}_2\text{O}_5$  0.07, = 100.18, corresponding to  $\text{CaFeSi}_2\text{O}_6 \cdot 69.4$ ,  $\text{CaMnSiO}_4 \cdot 4.3$ ,  $\text{CaMgSiO}_4 \cdot 22.6$ , excess  $\text{Fe}_2\text{SiO}_4$  0.7, mol.%; sp. gr. 3.434. The mineral is to be called *magnesian kirschsteinite*. Indexed X-ray powder data are tabulated. [M.M. 31-964; A.M. 43-790] J. Ph.

**[Shishkin (N. N.)]** Шишкин (Н. Н.). Джулукулит — новый кобальтовый минерал. [Dzhulukulite—a new cobalt mineral]. Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **121**, 724-726.



*Dzhulukulite* in the form of fine-grained aggregates, as impregnations, veinlets and nests in quartzite veins which cut across hydrothermally altered and oxidized porphyrites situated 10 km to the north-east of Dzhulu-Kul in the south-western part of the Tuva.

The mineral is opaque, grey in colour, grey streak, metallic lustre, H. 6, sp. gr. 6.36, octahedral crystals and irregular grains, zoned. Chemical analysis gave Co 26.00, Fe 0.55, Cu 1.05, As 45.52, S 18.81, SiO<sub>2</sub> 0.40, total 100.00, corresponding to (Co,Ni)AsS. X-ray data:  $a = 5.575$ , compared with  $a = 5.55$  for cobaltite, and  $a = 5.719$  for pyrrhotite. [A.M. 44-209] S. I. T.

**Levich (L. O.)** Станкевич (Л. О.). О составе и происхождении рудных силикатов Керченского месторождения. [On the composition and origin of the silicates of the Kerch deposits]. Минер. Сборник Львовского Геол. Общ. [Min. Mag. Lvov Geol. Soc.], 1957, no. 11, 159-169, 5 figs.

A new name 'ferrichlorites' is given to a group of chlorites that in the so-called 'tobacco ores' in the Kerch iron field. Chemical, X-ray, and thermal analyses of a number of ferrichlorites are given and their fine structure is discussed. S. I. T.

**Dobrokhotoy (M. N.)** Доброхотов (М. Н.). О новой разновидности хлорита из железистых кварцитов Галещинского месторождения Кременчугского района. [On a new variety of chlorite from a ferruginous quartzite of the Galeshchinsky deposit of the Kremenchug region]. Минер. Сборник Львовского Геол. Общ. [Min. Mag. Lvov Geol. Soc.], 1957, no. 11, 295-302, 1 fig.

*Kremenchugite* is a new name given to a variety of a pleochroic ferruginous-magnesian clinocllore intermediate between thuringite and cronstedtite. It occurs in the form of minute scales of a dark green colour, pleochroism  $\alpha$  bright reddish-brown,  $\gamma$  deep dark green, extinction straight, elongation positive; for three samples (1)  $\alpha = 1.692$ ,  $\gamma = 1.694$ , (2)  $\alpha = 1.697$ ,  $\gamma = 1.703$ , (3)  $\alpha = 1.702$ ,  $\gamma = 1.706$ . Chemical analysis gave (in brackets analysis after deduction of about 4% quartz and about 6% chalybite): SiO<sub>2</sub> 29.39 (27), TiO<sub>2</sub> 0.30 (0.34), Al<sub>2</sub>O<sub>3</sub> 5.55 (6.19), Fe<sub>2</sub>O<sub>3</sub> 14.77 (14), FeO 30.53 (30.43), MnO 0.25 (0.28), MgO 5.97 (5.9), CaO 1.70 (1.76), Na<sub>2</sub>O + K<sub>2</sub>O 1.04 (1.15), CO<sub>2</sub> 2.46 (2.5), H<sub>2</sub>O + 8.60 (9.62), = 100.56 (100.00). The fine structure of this mineral is discussed in the light of the X-ray data. [A.M. 44-209] S. I. T.

**Thompson (M. E.), Roach (C. H.), & Meyrowitz (Robert).** *Sherwoodite, a mixed vanadium (IV)-vanadium (V) mineral from the Colorado Plateau.* Amer. Min., 1958, 43, 749-755, 1 fig., 3 tables.

*Sherwoodite*, a new vanadium mineral, is named for Alexander M. Sherwood of the U.S. Geological Survey. It has the probable formula Ca<sub>3</sub>V<sub>8</sub>O<sub>22</sub>·15H<sub>2</sub>O and has been found in small amounts in numerous vanadium mines on the Colorado Plateau. It occurs as dark, blue-black, holohedral, tetragonal crystals, ditetragonal-dipyramidal (4/m2/m2/m), bounded by {110} and {011}. The space group is *I4/amd* (*D*<sub>4h</sub><sup>19</sup>),  $a = 27.8 \pm 0.08$ ,  $c = 13.8 \pm 0.08 \text{ \AA}$ ,  $a : c = 1 : 0.4964$ ; the cell contains 16 (Ca<sub>3</sub>V<sub>8</sub>O<sub>22</sub>·15H<sub>2</sub>O). The chemical analysis is: CaO 13.2, MgO 0.5, V<sub>2</sub>O<sub>5</sub> 5.9, Al<sub>2</sub>O<sub>3</sub> 2.6, Fe<sub>2</sub>O<sub>3</sub> 0.8, V<sub>2</sub>O<sub>5</sub> 50.2, H<sub>2</sub>O 23.1, insol. 3.8, = 100.1. Details of the analytical procedure are given. *Sherwoodite* is uniaxial negative,  $\omega = 1.765 \pm 0.003$ ,  $\epsilon = 1.735 \pm 0.003$ ; the dichroism is strong with  $\omega$  green and  $\epsilon$  blue; H. about 2, sp. gr.  $2.8 \pm 0.1$ . B. H. B.

**Sun (Ming-Shan) & Weber (R. H.).** *Santafeite, a new hydrated vanadate from New Mexico.* Amer. Min., 1958, 43, 677-687, 2 figs., 4 tables.

The full account following a preliminary note. [M.A. 13-624]. *Santafeite* is a new hydrated vanadate, Na<sub>2</sub>O·3MnO<sub>2</sub>·6(Mn,Ca,Sr)O·3(V,As)<sub>2</sub>O<sub>5</sub>·8H<sub>2</sub>O, found in the Grants uranium district, McKinley Co., N.M. It is named after the Atchison, Topeka, and Santa Fe Railroad Company. It occurs as small acicular crystals in rosettes encrusting joint surfaces of Todilto limestone. Physical and optical properties are: cleavage (010) perfect and (110) distinct, very brittle; measured density 3.379; black color, brown streak, subadamantine lustre, translucent only on small fragments; readily fusible in an alcohol flame to a dull black bead; pleochroic from dark reddish brown to yellowish brown with absorption  $\alpha > \beta > \gamma$ ;  $\alpha$  ( $\parallel c$ ) 2.01, distinct dispersion. X-ray studies by rotation, Laue, Weissenberg, and powder diffraction methods indicate orthorhombic symmetry, space group *B*22<sub>1</sub>2, *D*<sub>2</sub><sup>5</sup>, with cell dimensions  $a = 9.25$ ,  $b = 30.00$ ,  $c = 6.33 \text{ \AA}$ , all  $\pm 0.02 \text{ \AA}$ . A partial quantitative micro-chemical analysis gave V<sub>2</sub>O<sub>5</sub> 35.6, MnO<sub>2</sub> 16.6, MnO 13.7, CaO 6.2, SrO 6.0, Na<sub>2</sub>O 4.1, K<sub>2</sub>O < 0.1, As<sub>2</sub>O<sub>5</sub> 2.2, Fe<sub>2</sub>O<sub>3</sub> 0.9, CoO 0.1, NiO 0.1, CuO 0.5, UO<sub>3</sub> 0.3, insol. + SiO<sub>2</sub> 0.8, H<sub>2</sub>O 8.8, CO<sub>2</sub> 0.3, = 96.2, H<sub>2</sub>O - 0.2. The procedure for this analysis was based on a semi-quantitative spectrographic analysis by Katherine E. Valentine. [M.M. 31-971] B. H. B.

## PHYSICAL PROPERTIES OF MINERALS

[Povarennykh (A. S.)] Поваренных (А. С.). О магнитных свойствах минералов. [*Magnetic properties of minerals*]. Минер. Сборник Львовского Геол. Общ. [Min. Mag. Lvov Geol. Soc.], 1957, no. 11, 52-68.

Specific magnetic susceptibilities of a number of minerals are given and discussed, and a scale is constructed. It is suggested that magnetism in minerals is determined by the presence of elements—magnetophores—which are characterized by unpaired electrons present in the outer shells. The other factors are valency, nature of bond, and type of coordination.

S. I. T.

Haigh (G.). *Observations on the magnetic transitions in hematite at  $-15^{\circ}\text{C}$* . Phil. Mag., 1957, ser. 8, 2, 877-890, 8 figs.

It is shown that the magnetic properties of hematite may be ascribed to two magnetically independent components of ferromagnetism, one dependent on the antiferromagnetic transition at  $-15^{\circ}\text{C}$  and the other independent of this transition. The magnetic properties of these two components have been determined and the inadequacy of the magnetic structure for hematite proposed by Néel in accounting for some of the observations is pointed out.

R. A. H.

Haigh (G.). *The effect of added titanium and aluminium on the magnetic behaviour of  $\alpha$ -ferric oxide*. Phil. Mag., 1957, ser. 8, 2, 505-520, 7 figs.

The antiferromagnetic transition at  $-15^{\circ}\text{C}$  is still observed in synthetic hematite when up to about 10% Al or Ti impurity is present. Massive natural hematite showed the antiferromagnetic transition while specular, detrital and cement forms of hematite showed no transition: this is thought to be due not to the presence of impurities but to some effect of the crystal structure.

R. A. H.

Aramaki (Shigeo) & Akimoto (Syun-iti). *Temperature estimation of pyroclastic deposits by natural remanent magnetism*. Amer. Journ. Sci., 1957, 255, 619-627, 10 figs.

R. A. H.

Almond (M.), Clegg (J. A.) & Jaeger (J. C.). *Remanent magnetism of some dolerites, basalts and volcanic tuffs from Tasmania*. Phil. Mag., 1956, ser. 8, 1, 771-782.

Magnetic measurements on samples varying in age from

Triassic to early Tertiary. Magnetic dips very considerable greater than the present dip in Tasmania support suggestion that there has been relative movement between the land mass of Tasmania and the geographical since the early Tertiary period. Magnetic reversal at certain depths, in both dolerites and tuffs, are discussed in detail.

W. H. J.

Collinson (D. W.), Creer (K. M.), Irving (E.), & Runcorn (S. K.). *Palaeomagnetic investigations in Great Britain*. Phil. Trans. Roy. Soc., 1957, 250, A, 71-72.

An introduction to the following six papers.

Collinson (D. W.), Creer (K. M.), Irving (E.), & Runcorn (S. K.). I. *The measurement of the permanent magnetization of rocks*. Ibid., 73-82, 9 figs., 1 pl.

Irving (E.) & Runcorn (S. K.). II. *Analysis of the paleomagnetism of the Torridonian sandstones of north-west Scotland*. Ibid., 83-99, 19 figs.

Irving (E.). III. *The origin of the palaeomagnetism of Torridonian sandstones of north-west Scotland*. Ibid., 100-110, 6 figs.

Creer (K. M.). IV. *The natural remanent magnetization of certain stable rocks from Great Britain*. Ibid., 111-122, 12 figs.

Creer (K. M.). V. *The remanent magnetization of unconsolidated Keuper Marls*. Ibid., 130-143, 14 figs.

Creer (K. M.), Irving (E.), & Runcorn (S. K.). VI. *Physical interpretation of palaeomagnetic directions in Great Britain*. Ibid., 144-156, 2 figs.

R. A.

Ishikawa (Y.) & Akimoto (S.). *Effect of heat treatment on the magnetic properties of the  $\text{FeTiO}_3$ - $\text{Fe}_2\text{O}_3$  solution series*. Journ. Phys. Soc. Japan, 1957, 12, 834-835.

In the series  $x\text{FeTiO}_3 \cdot (1-x)\text{Fe}_2\text{O}_3$  the intensity of magnetization of specimens for which  $x \approx 0.5$  is remarkably affected by heat treatment. Quenching from temperatures between  $1100^{\circ}$  and  $950^{\circ}\text{C}$  results in an intensity of magnetization of 2 gauss/gram or less at room temperature. Slow cooling produces an intensity which may be as high as 24 gauss/gram at room temperature. This phenomenon is interpreted as the result of order-disorder transformation at a temperature near  $600^{\circ}\text{C}$ .

G. D.



- (T.), Yukutake (T.), & Uyeda (S.). *On magnetic susceptibility of olivines*. Journ. Geomag. Geoelect., 1957, **9**, 51-56.
- magnetic susceptibilities of several olivines have been measured and the paramagnetic nature of olivines is demonstrated. For the series forsterite-fayalite the mole-magnetic susceptibility can be expressed empirically as  $x \times 10^{-3}$  e.m.u./mol. at room temperature where  $x$  is the molecular fraction of fayalite in the olivine. The experimental results harmonize with calculated values of the magnetic susceptibility of these minerals at room temperature, which equates to  $2.2x$  to about  $2.6x \times 10^{-2}$  e.m.u./mol. if the Bohr magneton number of the  $\text{Fe}^{2+}$  ion is the accepted value and there is no magnetic interaction between  $\text{Fe}^{2+}$  ions in the structure. A general expression for the paramagnetic susceptibility for minerals is derived.
- G. D. N.
- Uyeda (P. M. S.). *Introductory remarks*. Advances in Geophysics (Supplement to Phil. Mag.), 1957, **6**, 147-148.
- Introduction to the following papers given at the first International Conference on Rock Magnetism.
- Uyeda (K. W. T.) & Hales (A. L.). *Palaeomagnetic measurements on Karroo dolerites*. Ibid., 149-161.
- Uyeda (A. E. M.). *Palaeomagnetic collections from Britain and South Africa illustrating two problems of weathering*. Ibid., 162-168.
- Uyeda (S. K.). *The sampling of rocks for palaeomagnetic comparisons between the continents*. Ibid., 169-176.
- Uyeda (P. M.). *Comparison of palaeomagnetic results for selected rocks of Great Britain and North America*. Ibid., 177-186.
- Uyeda (J. C.). *Palaeomagnetic investigations of Carboniferous rocks in England and Wales*. Ibid., 187-191.
- Uyeda. *Recent magnetic investigations at Cambridge University*. Ibid., 192-193.
- Uyeda (E.). *Rock magnetism: a new approach to some palaeogeographic problems*. Ibid., 193-218.
- Uyeda (J. A.), Deutsch (E. R.), Everitt (G. W. F.), & Stubbs (P. H. S.). *Some recent palaeomagnetic measurements made at Imperial College [London]*. Ibid., 219-231.
- Uyeda (T.). *Magneto-geological mapping in Iceland*. Ibid., 232-239.
- Sigurgeirsson (Th.). *Direction of magnetization in Icelandic basalts*. Ibid., 240-246.
- Brynjólfsson (A.). *Studies of remanent magnetism and viscous magnetism in the basalts of Iceland*. Ibid., 247-254.
- Nagata (T.), Akimoto (S.), Uyeda (S.), Shimizu (Y.), Ozima (M.), & Kobayashi (K.). *Palaeomagnetic study on a Quaternary volcanic region in Japan*. Ibid., 255-263.
- Nagata (T.), Uyeda (S.), & Ozima (M.). *Magnetic interaction between ferromagnetic minerals contained in rocks*. Ibid., 264-288, 12 pls.
- The effect of heat treatment up to  $1200^\circ\text{C}$  on the thermoremanent magnetism of ferromagnetic ilmenites is examined.
- Akimoto (S.). *Magnetic properties of ferromagnetic oxide minerals as a basis of rock-magnetism*. Ibid., 288-298.
- The mutual relations between the lattice parameter, Curie point, and chemical composition of both titanomagnetites and ilmenite-hematite series minerals are discussed. [M.M. **31**-443, 624; M.A. **11**-368, 12-499, 14-62]
- Parry (J. H.). *The problem of reversed magnetizations and its study by magnetic methods*. Ibid., 299-305.
- Griffiths (D. H.), King (R. F.), & Wright (A. E.). *Some field and laboratory studies of the depositional remanence of recent sediments*. Ibid., 305-316.
- Balsley (J. R.) & Buddington (A. F.). *Remanent magnetism of the Russell belt of gneisses, north-west Adirondack Mountains, New York*. Ibid., 317-322.
- Millman (A. P.). *Reflection microscopy of ferromagnetic minerals*. Ibid., 323-326, 4 pls.
- Doell (R. R.). *Crystallization magnetization*. Ibid., 327-332.
- Slichter (L. B.). *Remarks relative to Maxwell's formula for the magnetic susceptibility of disseminated materials*. Ibid., 333-335.
- Gorter (E. W.). *Chemistry and magnetic properties of some ferrimagnetic oxides like those occurring in nature*. Ibid., 336-361.
- The crystal chemistry of the spinel, hematite, and pseudobrookite structures is discussed.
- Graham (J. W.). *The role of magnetostriction in rock magnetism*. Ibid., 362-363.

**Finlayson (D. M.) & Greig (D.).** *Electrical measurements on natural galena at low temperatures.* Proc. Phys. Soc., 1956, **69**, B, 796-801.

The Hall effect and resistivity of single crystals of galena containing  $6 \times 10^{15}$ – $10^{19}$  extrinsic electrons/cm<sup>3</sup> have been measured from room temperature down to 4°K. No appreciable change in the number of extrinsic electrons was found at low temperatures.

R. A. H.

**Kakitani (S.).** *Dielectric dispersion of allanite.* Journ. Min. Soc. Japan, 1956, **3**, 32-38 (in Japanese).

The dielectric dispersion of allanite is attributed to the recrystallization of partly metamict material. The cell parameters of allanite from Daimonjiyama are: for unheated material (and for material quenched from 840°C)  $a$  8.84 (8.83),  $b$  5.73 (5.62),  $c$  10.25 (10.50) Å,  $\beta$  115° 05' (117° 30').

R. A. H.

**Buerger (M. J.) & Niizeki (N.).** *The correction for absorption for rod-shaped single crystals.* Amer. Min., 1958, **726**–731, 3 figs., 1 table.

There is a simple relation between the forms of transmission factors for upper levels and the zero level for rod-shaped specimens. When the equi-inclination technique is used, the several ray paths for a given  $Y$  have lengths  $x_1$  for the zero level, while the ray paths for the upper level at the same  $Y$  are  $x_1/\cos \nu$ .  $Y$  is the angular component in a plane normal to the cylinder axis,  $\nu$  is the angular component in the plane of the cylinder axis. If the form of the transmission factor for the zero level is known, the form for the upper level is therefore the same. For the same value of  $Y$ , except that the geometrical scale of the cross-section is increased by the factor  $1/\cos \nu$ . The resulting correction for absorption for all levels is especially easy to apply if the cross-section of the crystal is circular.

B. H.

## ROCK-FORMING MINERALS AND PETROLOGY

**[Vasilieva (Z. V.), Litzarev (M. A.), & Organova (N. I.)]** Васильева (З. В.), Лицарев (М. А.) и Органова (Н. И.). О природном сульфатапатите. [On a natural sulphate-apatite.] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.R.S.S.], 1958, **118**, 577-580, 1 fig.

The apatite from the phlogopite deposit Nadezhnoe, Aldan region, is found in association with phlogopite, diopside, scapolite, and calcite. Under the microscope the apatite appears to be made of composite crystals with cores made of Na-S-apatite ( $n$  1.675, almost isotropic) and the rims made of ordinary Cl-OH-apatite ( $n$  1.633,  $\omega$  1.642). The chemical analysis and the X-ray data support the conclusion that there are these two varieties of apatite in the aggregate on which the original Na-S-apatite is paragenetically replaced by an ordinary apatite. [M.A. 9-13]

S. I. T.

**[Rudenko (S. A.)]** Руденко (С. А.). О способе и механизме образования кристаллов циркона в мариуполите. [On the manner and the mechanism of formation of crystals of zircon in mariupolite.] Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1957, **86**, 454-458, 9 figs.

The microscopical study of thin sections of zircons in mariupolite, which frequently appear as skeletal and zoned crystals, suggests that zircons were formed in the solid body of the rock under the action of penetrating post-magmatic solutions. Skeletal crystals are explained as being formed

in an anisotropic medium, zoned crystals as being formed by the pulsational penetration of mineralizing solution.

S. I.

**Alper (Allen M.) & Poldervaart (Arie).** *Zircons from Animas stock and associated rocks, New Mexico.* Eng. Geol., 1957, **52**, 952-971, 7 figs.

Zircons have been studied by measurement of length and width of 200 crystals for each sample. Samples from various parts of the Animas quartz monzonite porphyry and from associated tuff, granitic xenoliths, a young extrusive, and five different granitic intrusives show that zircons may be used to characterize rocks of igneous origin and to distinguish derivatives of one magma from those of older or younger magmas, even if the rocks are of identical chemical and mineralogical composition. [M.A. 13-296]

R. A. I.

**Miyashiro (A.).** *The chemistry, optics and genesis of alkali-amphiboles.* Journ. Fac. Sci. Tokyo Univ., 1957, Sect. 2, **11**, 57-83, 9 figs.

In a compilation and review of existing data on the chemical composition, substitution relations, optical properties, and modes of occurrence the alkali-amphiboles are divided into four groups: this division is on the basis of the  $(\text{Na}, \text{K})\text{R}^{2+} \rightleftharpoons \text{R}^{3+}$  and  $(\text{Na}, \text{K})\text{Al} \rightleftharpoons \text{Si}$  substitution where  $\text{R}^{2+}$  and  $\text{R}^{3+}$  represent divalent and trivalent at



ordination respectively. Each group is subdivided on the basis of the  $\text{Al} \rightleftharpoons \text{Fe}^{3+}$  substitution in  $R^{3+}$  and the  $\text{Fe}^{2+}$  substitution in  $R^{2+}$ . The idealized formulae of the main subdivisions are:—

glaucophane group:

riebeckite  $\text{Na}_2\text{Fe}^{2+}_3\text{Fe}^{3+}_2\text{Si}_6\text{O}_{22}(\text{OH})_2$

magnesioriebeckite  $\text{Na}_2\text{Mg}_3\text{Fe}^{3+}_2\text{Si}_6\text{O}_{22}(\text{OH})_2$

glaucophane  $\text{Na}_2\text{Mg}_3\text{Al}_2\text{Si}_8\text{O}_{22}(\text{OH})_2$

arfvedsonite group:

arfvedsonite  $\text{Na}_2\text{Ca}_1\text{Fe}^{2+}_{31}\text{Fe}^{3+}_{11}\text{Si}_{71}\text{Al}_1\text{O}_{22}(\text{OH})_2$

magnesioarfvedsonite  $\text{Na}_2\text{Ca}_1\text{Mg}_{31}\text{Fe}^{3+}_{11}\text{Si}_{71}\text{Al}_1\text{O}_{22}(\text{OH})_2$

katophorite group:

katophorite  $\text{Na}_2\text{CaFe}^{2+}_4\text{Fe}^{3+}_1\text{Si}_7\text{AlO}_{22}(\text{OH})_2$

magnesiokatophorite  $\text{Na}_2\text{CaMg}_4\text{Fe}^{3+}_1\text{Si}_7\text{AlO}_{22}(\text{OH})_2$

tremolite group:

tremolite  $\text{Na}_2\text{CaMg}_5\text{Si}_8\text{O}_{22}(\text{OH})_2$

In the riebeckite–arfvedsonite–katophorite series the reaction temperature increases generally with the increase in  $\text{Fe}^{3+}/\text{Al}$ : it is noted that glaucophane, the high pressure member, is high in 6-coordinated Al while the katophorite, the high temperature member, is high in 4-coordinated Al. The relationship of chemical composition to physical properties is discussed. [M.A. 5-216, 9-270, 271, R. A. H.]

**Uchida (Akiho) & Iwasaki (Masao).** *Magnesioriebeckite in crystalline schists of Bisan in Sikoku, Japan.* Journ. Geol. Soc. Japan, 1957, **63**, 698–703.

Magnesioriebeckite [see preceding abstract] occurs in a glaucophane–aegirine–amphibole–muscovite–quartz schist at Kurohara in the city of Tokushima. The aegirine has  $\alpha:c=1:2$ ,  $2V_\alpha$  64–84°,  $\beta$  1.74; and the muscovite has  $\alpha:c=1:2$ ,  $2V_\alpha$  22.60,  $\text{Fe}_2\text{O}_3$  7.43,  $\text{FeO}$  0.82,  $\text{MgO}$  3.52. The amphibole is strongly zoned with a nearly colourless core, with  $\alpha:c=1:2$ ,  $2V_\alpha$  10,  $\gamma$  1.650,  $\beta=b$ ,  $\alpha:c=17^\circ$ ,  $2V_\alpha$  30° (yellow light), and a pleochroic rim with  $\alpha$  1.660,  $\gamma$  1.670,  $\gamma=b$ ,  $2V_\alpha$  28°,  $2V_\alpha$  43° (yellow light),  $r<v$ , pleochroism  $\alpha$  very yellow,  $\beta$  blue,  $\gamma$  purple. The analysis of the coloured amphibole (with a small amount of colourless core material) gave: Haraoka gave  $\text{SiO}_2$  55.62,  $\text{Al}_2\text{O}_3$  4.54,  $\text{TiO}_2$  0.26,  $\text{FeO}$  12.99,  $\text{Fe}_2\text{O}_3$  3.53,  $\text{MnO}$  1.25,  $\text{MgO}$  11.98,  $\text{CaO}$  1.95,  $\text{K}_2\text{O}$  5.58,  $\text{H}_2\text{O}+$  0.36,  $\text{H}_2\text{O}-$  0.00,  $\text{P}_2\text{O}_5$  0.00,  $\text{loss}$  100.09. The mineral is thus rich in alkalis but the schist is poor in them: the formation of magnesioriebeckite appears to be due to recrystallization under the conditions of glaucophanitic metamorphism and not primarily due to alkali metasomatism. [M.A. 2-346, 11-17,200] R. A. H.]

**Rose (Robert L.).** *Andalusite- and corundum-bearing pegmatites in Yosemite National Park, California.* Amer. Min., 1957, **42**, 635–647, 5 pls.

Five pegmatites with quartz, orthoclase ( $2V_\alpha$  55°) plagioclase ( $\text{An}_{25}$ ), biotite, muscovite, andalusite, corundum, tourmaline, and titaniferous hematite occupy the *ac* joints of interbedded pelitic hornfels and quartzite in the marginal portion of a roof pendant at May Lake, Yosemite National Park. The andalusite occurs as striated brown prismatic crystals up to four inches in length and has  $\alpha$  1.646,  $\gamma$  1.656,  $2V_\alpha$  84°;  $\alpha$  pale pink,  $\beta=\gamma$  pale greenish to colourless, dispersion strong about  $\alpha$  with  $r<v$ , sp.gr. 3.14: some crystals are zoned with irregular bands having slightly lower birefringence and stronger pleochroism. Corundum is found embedded in muscovite associated with the andalusite, it is zoned and varies in colour from blue to colourless and yellow: bluish grains have  $\alpha$  1.761,  $\beta \approx 1.768$ ,  $\gamma$  1.769,  $2V_\alpha$  17°;  $\alpha=c$ ;  $\alpha$  bluish-green to nearly colourless,  $\beta=\gamma$  deep to pale blue: yellow grains appear to have a smaller  $2V$  and slightly higher refr. ind. The pegmatites are thought to have formed by magmatic injection and reaction of the magma with the wall rocks, with the formation of andalusite in the reaction zones: later potash metasomatism partly converted the andalusite to a mixture of muscovite, corundum, and diasporite. [M.A. 7-407] R. A. H.]

**Wager (L. R.), Vincent (E. A.), & Smales (A. A.),** with appendix by Bartholomé (P.). *Sulphides in the Skaergaard intrusion, east Greenland.* Econ. Geol., 1957, **52**, 855–903, 20 figs.

The distribution of various sulphides (bornite, digenite, chalcopyrite, covellite, pyrrhotine, pyrite, and marcasite) in the gabbros of the Skaergaard intrusion is interpreted as a result of immiscibility of a sulphide liquid with the silicate during the formation of these rocks. During the formation of most of the layered gabbros this sulphide liquid was copper-rich but during the later stages it was rich in ferrous sulphide. The compositions of the earlier sulphide liquids have been indirectly estimated. An analysis is given of the pyrrhotine formed at a later stage ( $\text{Fe}$  61.75,  $\text{S}$  37.53,  $\text{Mn}$  0.03,  $\text{As}$  0.005,  $\text{Ni}$  0.0001,  $\text{Co}$  0.0232,  $\text{Cu}$  0.0149,  $\text{Pd}$  0.000001,  $\text{Au}$  0.0000003, loss at 110°C 0.34, insol. in acid 0.49, = 100.18). Immiscibility of the copper-rich sulphide liquid developed when the Cu and S contents of the magma were about 0.02 and 0.01% respectively. Iron sulphide separated later when the S content had risen to 0.06% and the ferrous iron content was about 15%. The

partition of Cu, Ni, and Co between silicate and sulphide liquids is determined for various stages of fractionation. Pd, In, and, to a less extent, Au do not appear to enter the sulphide liquid preferentially to the silicate. Theoretical and thermodynamic considerations on the separation of the sulphides and their crystallization are discussed in an appendix.

G. D. N.

**Yoder (H. S., Jr.) & Sahama (Th. G.).** *Olivine X-ray determinative curve.* Amer. Min., 1957, **42**, 475-491.

The 130 spacing of thirty-one chemically analysed natural olivines and seven synthetic olivines has been measured. A determinative curve has been calculated from twenty-six of the analysed natural olivines, its equation being  $Fo$  (mol.%) =  $4233.91 - 1494.59 d_{130}$ : the extrapolated end points are  $d_{130}$  ( $Fo = 100$ ) 2.7659,  $d_{130}$  ( $Fo = 0$ ) 2.8328. The error attached to an individual measurement ranges from 3 to 4 mol. %, depending on the composition. Synthetic forsterite has  $a$  4.756,  $b$  10.195,  $c$  5.981, sp. gr. (calc.) 3.222, synthetic fayalite having  $a$  4.817,  $b$  10.477,  $c$  6.105, sp. gr. (calc.) 4.392: portions of the X-ray powder patterns for synthetic forsterite and fayalite have been indexed. For synthetic tephroite  $d_{130}$  is 2.8697. Nine previously unpublished analyses are tabulated. [M.A. 14-137]

R. A. H.

**Wilkinson (J. F. G.).** *The olivines of a differentiated teschenite sill near Gunnedah, New South Wales.* Geol. Mag., 1956, **93**, 441-455, 1 fig.

The optical properties and deduced compositions, as a forsterite: fayalite molecular ratio, have been determined for olivines from nearly sixty teschenites from a 500 ft. thick sill. Compositions, based on  $\beta$  refractive index and  $2V$ , range from  $Fa_{21}$  near the base to  $Fa_{60}$  near the top, there being no gaps in the crystallization sequence (cf. tholeiitic olivines). Groundmass olivines are 2 to 8 mol. % richer in Fa than phenocrysts in the same rock, while zoned crystals show a range of 20% fayalite between core and margin. [M.A. 13-532]

G. M. B.

**Drever (H. I.) & Johnston (R.).** *Crystal growth of forsteritic olivine in magmas and melts.* Trans. Roy. Soc. Edin., 1957, **63**, 289-315, 23 figs., 2 pls.

Variation in the shapes and textural relations of forsteritic olivines in minor intrusions, lavas, and melts is examined and the historical development of concepts of their growth and resorption, particularly in magmas, is traced.

Particular attention is focused on the olivines of minor intrusions. It is shown that forsteritic olivines to grow rapidly and that their great variation in habit shape is probably due to a specific growth sensitive to slight environmental differences. Concepts of the physical conditions leading to skeletal crystallization are reviewed and discussed. Chemical analysis of an olivine ( $Fo_{89.5}$ ) from the centre of a picritic sheet (sheet 2), east coast of Ubekeendt Ejland, West Greenland [M.A. 13-409], by Murray, gave  $SiO_2$  39.81,  $TiO_2$  tr.,  $FeO$  10.20,  $MnO$  0.10,  $MgO$  49.03,  $CaO$  0.75,  $H_2O$  0.04, = 99.96:  $2V_a$  9°. Analyses are also given for a picritic basalt from Ubekeendt Ejland and a variolitic olivine-basalt from Point of Skye.

R. A.

**Muir (I. D.) & Tilley (G. E.),** with chemical analysis by **Scoon (J. H.).** *Contributions to the petrology of Hawaiian basalts. I. The picrite basalts of Kilauea.* Journ. Sci., 1957, **255**, 241-253, 3 figs.

Two new analyses of tholeiitic picrite-basalts of Kilauea are given together with optical and chemical data on some of the principal minerals in these and other ultrabasic rocks from Kilauea. From a laccolithic intrusive "gabbro" the augite A ( $Ca_{39.5}Mg_{49.8}Fe_{10.7}$ ) and bronzoite B ( $Ca_{5.3}Mg_{73.4}Fe_{21.3}$ ) have been analysed. From the flow of picrite-basalt analyses are given of the phenocrysts of augite C ( $Ca_{40.0}Mg_{49.0}Fe_{11.0}$ ) and the groundmass of augite D ( $Ca_{34.2}Mg_{48.0}Fe_{17.8}$ ). From the compositions (from optics) of the olivines and pyroxenes in two pyroclastic ejected blocks, one thoroughly metamorphosed and the other partially metamorphosed, it is shown that the position of the tie lines in the diagram Wo-En-Fs is different from that shown by unmetamorphosed intrusive bodies. The trend of iron enrichment in the clinopyroxene from the 1921 olivine basalt flow is shown by the change in composition, three separate fractions having been separately analysed.

	$SiO_2$	$Al_2O_3$	$TiO_2$	$Cr_2O_3$	$Fe_2O_3$	FeO	MnO
A	51.62	3.14	0.72	0.49	1.25	5.63	0.14
B	52.87	2.14	1.12	0.11	1.10	12.59	0.26
C	51.72	3.82	0.92	0.52	0.90	5.77	0.14
D	52.39	4.00	1.43	0.54	1.55	8.59	0.21

	CaO	Na <sub>2</sub> O	K <sub>2</sub> O	H <sub>2</sub> O-	Total	$\alpha$	$\beta$	$\gamma$
A	19.45	0.32	0.01	n.d.	100.19	1.684	1.689	1.712 (+)
B	2.72	0.16	0.04	0.03	99.84	1.685	1.692	1.696 (-)
C	19.13	0.45	0.05	nil	100.22	1.686	1.692	1.713 (+)
D	15.17	0.70	0.21	nil	100.04	1.688 (min.)		1.717 (max.) (+)

W. S.



(Victor T.) & Fahey (Joseph J.). *Some pyroxenes associated with pyrometasomatic zinc deposits in Mexico and New Mexico*. Bull. Geol. Soc. America, 1957, **68**, 31-896, 2 figs., 3 pls.

characteristic pyroxenes in these pyrometasomatic deposits are manganian hedenbergite and manganian magnesian hedenbergite: johannsenite and ferroan johannsenite also occur and rhodonite is sometimes found replacing the manganese being supplied from the invading mass of visible or concealed stocks. On the basis of temperature at which andradite loses its birefringence early stage of silicate deposition probably began at a temperature below 860°C. Later, possibly at around 700°C, uralitization of the pyroxenes took place with a loss of MnO and a gain in SiO<sub>2</sub>, FeO, Al<sub>2</sub>O<sub>3</sub>, and MgO: analysis A (α = β pale brown, γ light brown) from 10th level, San Antonio mine, Santa Eulalia, Chihuahua, Mexico, two further analyses of New Mexico specimens suggest the variety of uralite thus produced is cummingtonite. Magnetite, pyrite, and some magnetite are later than the pyroxenes and were formed by lower temperature hydrothermal solutions. Ferroan diopside B is from pegmatite, Strike mine, Organ Mountains, New Mexico: ferroan johannsenite C from Star mine, Vanadium, New Mexico: manganian hedenbergite D from Linchburg tunnel, Santa Eulalia, New Mexico: magnesian hedenbergite E from 9th level, San Antonio mine, Santa Eulalia, Chihuahua, Mexico: all analyses by J. J. Fahey. Analyses of optical properties are also given for three further manganian hedenbergites and a ferroan johannsenite, together with several partial analyses.

SiO <sub>2</sub>	TiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	FeO	MnO	MgO	CaO	Na <sub>2</sub> O
30.42	0.06	0.78	1.24	22.91	2.82	4.45	2.82	0.22
33.62	0.06	0.50	0.09	6.51	1.78	13.50	23.78	0.27
18.98	0.14	0.84	1.07	11.30	14.13	2.19	20.64	0.10
18.78	0.04	0.90	0.22	18.18	8.51	1.26	21.14	0.21
19.58	0.06	0.38	4.30	16.93	4.62	3.35	20.46	0.30

K <sub>2</sub> O	H <sub>2</sub> O	Total	α	β	γ	γ:α	2V
0.31	3.38	99.73	1.623	1.644	1.655	8°	72° (-)
0.09	0.20	100.40	1.685	1.691	1.711	40°	56° (+)
0.05	0.44	99.88	1.703	1.711	1.732	46°	70° (+)
0.14	0.38	99.84	1.719	1.730	1.750	48°	68° (+)
0.15	0.42	100.55	1.725	1.736	1.754	47°	70° (+)

also includes ZnO 0.32; D, CO<sub>2</sub> 0.08). [M.A. 6-297, 12, 9-21, 12-374] R. A. H.

on (Brian). *Larnite, scawtite, and hydrogrossular from Tokatoka, New Zealand*. Amer. Min., 1957, **42**, 379-392.

an andesite dyke of probably Pliocene age near Tokatoka,

North Auckland, has metamorphosed the surrounding Lower Tertiary limestone of the Onerahi formation. From the contact outwards a series of mineralogical zones consists of 6 inches of hydrogrossular, followed by 30 inches of larnite, and then 10 inches of scawtite: other minerals present are cristobalite, opal, spurrite, gehlenite, and wollastonite. The hydrogrossular has a cell size varying from 11.95 to 12.24Å, this variation being independent of distance from the contact. The larnite rock forms a black, hard, flinty band, the dark colour being due to a small amount of fine-grained magnetite: the larnite has α 1.71, γ 1.73, and, like scawtite, was positively identified from an X-ray powder photograph: scawtite has α 1.60, γ 1.62. Analyses are given for the andesite (including 1.26% BaO), altered and unaltered limestone, hydrogrossular-cristobalite rock, larnite rock, and scawtite rock. The maximum temperature during metamorphism is estimated to be about 800°C. [M.M. 22-77, 222; M.A. 9-61, 11-197, 12-383]

R. A. H.

Goni (J.). *Sur un phénomène d'altération du sphène et les produits qui en résultent*. Bull. Soc. franç. Min. Crist., 1957, **80**, 199-208.

Petrographic details are given for a granodiorite batholith in the department of Maldonado, south-east Uruguay, with chemical analyses of the granulitic and the pegmatitic facies. Weak radioactivity in the granodiorite appears to be associated with a yellowish mineral resulting from the decomposition of sphene: this is identified as xanthitane and gives an X-ray powder diagram identical with that of anatase, its d.t.a. curve shows a strong endothermic peak at 98°C due to loss of hygroscopic water and two weaker endothermic peaks at 496° and 966°C. In the pegmatitic facies crystals of anatase pseudomorphing sphene were found; on heating to above 1000°C for 24 hours these did not transform into rutile: chemical analysis gave SiO<sub>2</sub> 10.75, TiO<sub>2</sub> 50.81, Fe<sub>2</sub>O<sub>3</sub> 24.29, U<sub>2</sub>O<sub>3</sub> 0.66, MgO 1.08, Na<sub>2</sub>O 0.44, K<sub>2</sub>O 0.87, H<sub>2</sub>O ± 11.05, = 99.95. R. A. H.

Carstens (Harald). *Note on the epidote in green-schists*. Norsk Geol. Tidsskr., 1955, **35**, 158-161, 2 figs.

In a pillow lava at Lokken in Trondelag, Norway, the pillows exhibit zones enriched in epidote parallel to the pillow boundaries. This is interpreted as due to a pre-metamorphic differentiation *in situ* in each pillow.

I. W. O.

**Hasegawa (Shuzo).** *Chemical studies of allanites and their associated minerals from the pegmatites in the northern part of the Abukuma massif.* Sci. Rep. Tohoku Univ., ser. 3 (Min., Petr., Econ. Geol.), 1957, **5**, 345-371, 10 figs., 1 pl.

Allanite is described from pegmatites intruded into granodiorite and granite in the Abukuma massif in Fukushima and Miyagi Prefectures, Japan. The procedures adopted for the chemical analysis of allanite are fully described and the results of eight analyses tabulated: no optical properties are given. The composition of the analysed allanites varies from allanite A, sp.gr. 3.86<sub>2</sub>, from Osawa pegmatite, Fukushima Prefecture, to that of allanite B, sp.gr. 3.94<sub>3</sub>, from Ohari pegmatite, Miyagi Prefecture. Seven chemical analyses of feldspar are listed, including plagioclase C from Fuzamata pegmatite, and microcline-perthite D from Hayamadake pegmatite, both in Fukushima Prefecture. The Ohari pegmatite also contained the almandine-spessartine garnet E, sp.gr. 4.24<sub>7</sub>, and lepidomelane F, while the Hayamadake pegmatite had, associated with the allanite, brown, prismatic fergusonite G, sp.gr. 5.46<sub>9</sub>, greyish-green to greyish-brown zircon H, sp.gr. 3.95<sub>7</sub>, in a variety containing rare-earth and P<sub>2</sub>O<sub>5</sub>, and amorphous brownish or yellowish thorogummite I. All analyses by S. Hasegawa.

	SiO <sub>2</sub>	TiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	FeO	MnO	MgO	CaO	ThO <sub>2</sub>
A	30.22	0.38	16.94	2.97	10.50	1.58	0.05	10.39	1.53
B	30.32	0.04	15.89	3.77	10.81	6.06	0.32	4.28	1.70
C	66.14	nil	21.00	0.08	—	tr.	nil	1.08	—
D	65.51	nil	18.98	0.10	—	0.01	nil	0.18	—
E	36.04	tr.	20.20	2.10	22.12	18.76	0.12	0.62	—
F	34.90	1.22	19.31	16.24	9.58	0.85	1.74	0.46	—
G	0.52	1.23	0.33	0.88	—	0.10	0.08	0.05	0.48
H	27.13	tr.	0.48	0.45	—	tr.	tr.	tr.	1.03
I	17.30	nil	0.64	12.40	—	tr.	0.05	0.22	43.23

	Ce <sub>2</sub> O <sub>3</sub>	(La) <sub>2</sub> O <sub>3</sub>	(Y) <sub>2</sub> O <sub>3</sub>	(Zr,Hf)O <sub>2</sub>	Na <sub>2</sub> O	K <sub>2</sub> O	H <sub>2</sub> O +	H <sub>2</sub> O -	Total
A	7.50	11.55	3.43	—	—	—	2.19	0.33	99.69
B	7.44	14.74	1.85	—	—	—	2.13	0.24	99.59
C	—	—	—	—	10.42	1.10	0.32	0.18	100.32
D	—	—	—	—	3.41	11.67	0.21	0.12	100.19
E	—	—	—	—	—	—	0.15	0.11	100.22
F	—	—	—	—	0.65	6.49	6.94	1.64	100.02
G	1.20	—	43.43	0.22	—	—	2.22	0.26	99.47
H	0.37	—	10.14	51.68	—	—	3.12	0.32	99.84
I	0.53	—	3.76	0.32	—	—	6.05	10.45	99.34

(A also includes BeO 0.13; G has UO<sub>2</sub> 1.66, UO<sub>3</sub> 1.54, Nb<sub>2</sub>O<sub>5</sub> 30.62, Ta<sub>2</sub>O<sub>5</sub> 14.60, PbO 0.05; H has UO<sub>2</sub> 1.75, P<sub>2</sub>O<sub>5</sub> 3.37; I has UO<sub>3</sub> 3.12, P<sub>2</sub>O<sub>5</sub> 0.74, CO<sub>2</sub> 0.53).

R. A. H.

**Barth (T. F. W.).** *Studies in gneiss and granite. I. Relation between temperature and the composition of the feldspar. II. The feldspar-equilibrium temperature in granitic rocks of the Pre-Cambrian of Southern Norway.* Skrifter Norske Vidensk.-Akad. Oslo, I. Mat.-Nat. Kl., 1956, no. 1, 35 pp., 16 figs.

The relation between temperature and the ratio of distribution of albite between alkali feldspars and coexisting plagioclases is discussed both from a theoretical viewpoint and by considering twenty analysed feldspar pairs. A diagram is presented relating the chemical composition (as given by *k*, the distribution ratio) to the temperature of crystallization. In part II use is made of this diagram to obtain the temperatures of crystallization for various Norwegian granitic rocks, the composition of whose coexisting alkali and plagioclase feldspars have been determined. The results vary from around 400°C for normal gneiss, through 450°C for anatectic granite, 550°C for diapirite granite, 570°C for small pegmatites, 600°C for large pegmatite dykes, to 640°C for augen gneiss.

R. A. H.

**Scharbert (H. G.).** *Zur Optik der Kalifeldspate.* Neues Jahrb. Min., Monatshefte, 1955, 33-41.

The geology of feldspathic rocks of Czechoslovakia and the Danube Basin is discussed on the basis of variation in the 2V values of the potassium feldspars.

R. A. H.

**Kuelmer (Frederick J.).** *Alkali feldspars in a Tertiary porphyry near Hillsboro, New Mexico.* Journ. Geol., 1958, **66**, 151-162.

The cryptoperthite phenocrysts of a funnel-shaped quartz monzonite porphyry intrusion were studied by chemical and X-ray methods. Measurement of 'δ', defined as the ratio of composition of cryptoperthite when determined by intensity measurements of 201 after short heat treatment to the calculated composition, show variation between samples taken in various parts of the intrusive. Higher parts of the intrusion show larger 'δ' values than lower parts. This is interpreted as showing that ordering and unmixing ceased at higher temperature in the more rapidly cooled portions of the intrusive.

H. L.

**[Sobolev (N. D.)]** Соколов (Н. Д.). Об анортоклазах в трахилипаритах Север-ого Кавказа. [On the anorthoclases in the trachyliparites of the Northern Caucasus.] Минер. Сборник Львовского Геол. Общ. [Min. Mag. Lvov Geol. Soc.], 1957, no. **11**, 248-264, 1 fig.



The conclusion reached by all the recent workers on the potash-soda feldspars and the optical data relating to the so-called 'anorthoclase' from the trachyliparite of the northern Caucasus, suggest that the feldspar in question is an albite-oligoclase  $\text{Ab}_{80}\text{Or}_{12}\text{An}_8$ . S. I. T.

**Hamilton (J.).** *Banded olivines in some Scottish Carboniferous olivine-basalts.* Geol. Mag., 1957, **94**, 135-139.

Banded structures, sub-parallel to (100), in olivine phenocrysts (approximate composition  $\text{Fa}_{22}$ , zoned outwards to  $\text{Fa}_{32}$ ) from some Scottish Carboniferous lavas, are believed to be of deformational origin. W. J. W.

**Rietz (T.).** *The content of chromium and nickel in the Caledonian ultrabasic rocks of Sweden.* Geol. Fören. Förh. Stockholm, 1956, **78**, 233-300, 52 figs.

Mineralogical examination of the different Swedish Caledonian peridotites and serpentines is reported, and a large number of chemical analyses and microphotographs of rocks and ores are given. The principal accessory ore mineral of these rocks was found to be a chrome-bearing magnetite, average  $\text{Cr}_2\text{O}_3$  0.4%. This magnetite is uniform in some occurrences, but in others it is zoned and has a core richer in chromite. The core is considered to be primary, whereas the shells formed during metamorphic processes, mainly during the serpentinization. The Fe:Cr ratio varies between 5 and 10. The possibilities of a Cr-magnetite being the usual accessory ore mineral of peridotites (dunites) is discussed. The Ni content of the peridotites and serpentines examined varies from 0.1 to 0.5%. During the serpentinization most of the Ni was transferred from the olivines into different sulphides (pentlandite, mackinawite, Ni-bearing pyrite, etc.). Comparison between the Caledonian deposits and those of other regions is made with reference to both macro- and micro-features of rocks and ores. P. Lggn.

**Swaan (P. C.) & Plas (L. van der).** *Optical and X-ray investigation of some pyroxenes and amphiboles from Nagpur, Central Provinces, India.* Proc. Koninkl. Nederl. Akad. Wetensch., 1958, **61B**, 265-277, 1 fig., 2 pls.

Samples obtained from The Central Provinces Manganese Ore Co. Ltd., taken from the manganese mines at Nagpur, India, contained the following minerals:—Juddite:

wine-red prisms ( $2 \times 0.5$  mm) with high lustre are associated with quartz, microcline, Mn-chlorite, apatite, epidote, biotite, and blanfordite; in Na light,  $\alpha$  1.658,  $\gamma$  1.668,  $2V_\gamma$  63°-72°, crossed dispersion  $r > v$  large,  $\alpha:c$  8°-35°, extinction not complete; pleochroism  $\alpha$  light yellow,  $\beta$  carmine,  $\gamma$  orange; X-ray powder data given in detail, pattern similar to that of riebeckite from Ras Zeit, Egypt, unit cell slightly smaller.—Tirodite is fibrous, straw coloured, with, in Na light,  $\beta$  1.648,  $\gamma$  1.655,  $2V_\alpha$  45°-66°,  $r > v$  large;  $\gamma:c$  17°-21°; pleochroism  $\beta$  colourless,  $\gamma$  pale yellow; X-ray powder data given in detail, pattern similar to that of glaucophane from Susatal, Italy, unit cell slightly larger.—Blanfordite in lilac-blue prisms associated with juddite, has, in Na light,  $\alpha$  1.767,  $\gamma$  1.799,  $2V_\alpha$  68°-72°,  $r > v$  large,  $\alpha:c$   $\pm 5^\circ$ ; pleochroism  $\alpha$  pink,  $\beta$  lilac,  $\gamma$  blue; X-ray powder data given in detail, pattern similar to that of acmite from Eker, Norway, unit cell smaller.—A brown manganese-bearing aegirine-augite, enclosing colourless amphibole, plagioclase and apatite, has, in Na light,  $\alpha$  1.732,  $\gamma$  1.755-1.759,  $2V_\gamma$  88°,  $r > v$  large,  $\alpha:c$  10°; pleochroism  $\alpha$  brown yellow,  $\gamma$  pale yellow; X-ray powder data given in detail, pattern similar to that of aegirine from Ditro, Rumania, unit cell slightly smaller; provisional chemical analysis showed relatively high Mn content. Further chemical data will be published later; the possibility of distinguishing by powder patterns between sodium-amphiboles and other groups of amphiboles is suggested. The association juddite-blanfordite may well be the Mn-rich facies of the association riebeckite-aegirine. L. P.

**Miyashiro (Akiho) & Seki (Yôtarô).** *Enlargement of the composition field of epidote and piemontite with rising temperature.* Amer. Journ. Sci., 1958, **256**, 423-430.

Evidence from metamorphic zones in the Kanto Mts., and in the Bessi district, Sikoku, Japan, shows that epidote and piemontite tend to have compositions near  $\text{HCa}_2\text{Al}_2\text{FeSi}_3\text{O}_{13}$  if formed at low temperature, but if formed at higher temperatures, they can accommodate progressively more variation of the parameters  $\text{Fe}^{\text{III}}/(\text{Fe}^{\text{III}} + \text{Al})$ , and  $\text{Mn}^{\text{III}}/(\text{Fe}^{\text{III}} + \text{Mn}^{\text{III}})$ . The relatively fixed composition of the low-temperature form is probably determined by the crystal structure, with Al in most (Al,Fe) sites within the  $(\text{Al,Fe})\text{O}_6$  and  $(\text{Al,Fe})\text{O}_4(\text{OH})_2$  chains along the  $b$ -axis, and Fe in most (Al,Fe) sites outside these chains. This accords with previously published data correlating variability of K/Na in nepheline with its temperature of formation. H. W.

**Davies (K. A.).** *The geology of part of south-east Uganda.* Geol. Surv. Uganda, Mem. **8**, 1956, vii+76 pp., 2 pls. Price 20s.

This comprehensive memoir deals mainly with the Pre-Cambrian gneisses, schists, granulites, greywackes and associated igneous rocks and with the Pre-Miocene, Post-Karoo alkaline complexes of Tororo, Sukulu, Bukusu, Sekululu, and Budeda. The minerals of the Sukulu carbonatite include calcite, dolomite, magnetite, apatite, mica, zircon ( $\omega$  1.95,  $\epsilon$  1.99), baddeleyite ( $2V_{\alpha}$  30°,  $\alpha$  2.11,  $\gamma$  2.18,  $\alpha : c$  12°), baryte, brown pyrochlore ( $n$  2.15, analysis by W. H. Bennett: Na<sub>2</sub>O 7.24, K<sub>2</sub>O 0.07, CaO 14.82, MgO 0.49, ThO<sub>2</sub> 0.37, Ce<sub>2</sub>O<sub>3</sub> 0.62, La<sub>2</sub>O<sub>3</sub> 1.38, ZrO<sub>2</sub> 1.91, Fe<sub>2</sub>O<sub>3</sub> 0.48, Al<sub>2</sub>O<sub>3</sub> 0.20, TiO<sub>2</sub> 0.56, Nb<sub>2</sub>O<sub>5</sub> 68.72, Ta<sub>2</sub>O<sub>5</sub> 0.20, F 3.87, H<sub>2</sub>O+ 0.50, H<sub>2</sub>O— 0.14, less 0 = F 1.63, = 99.94), and tremolite ( $\alpha$  1.598,  $\gamma$  1.624,  $\gamma : c$  = 18°). In the carbonatites of the Bukusu complex the apatite A tends to recrystallize in the weathered zone as reformed apatite or as francolite (staffelite) B: the latter occurs as stellate and fibrous aggregates around cores of other minerals and has  $\epsilon$  1.611,  $\omega$  1.622. Ten rock analyses are given and also that of a biotite from a biotite pyroxenite. [M.A. 10-282, 11-502, 12-577]

	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	CaO	MgO	P <sub>2</sub> O <sub>5</sub>	F	CO <sub>2</sub>	H <sub>2</sub> O>300°C
A	0.65	6.05	47.60	0.23	35.52	1.96	0.43	0.85
B	n.d.	0.11	55.35	0.14	39.55	3.79	1.80	0.85

	H <sub>2</sub> O(105-300°C)	H <sub>2</sub> O—	Insol. res.	O≡F	Total
A	0.35	0.20	6.90	0.82	99.92
B	0.18	0.30	0.05	1.60	100.52

R. A. H.

**Struwe (H.).** *Data on the mineralogy and petrology of the dolomite-bearing northern contact zone of the Quérigut granite, French Pyrenees.* Leidse Geol. Mededel., 1957-1958, **22**, 237-349, 46 figs. (English with English, French, and Dutch summaries.)

The homogeneous main part of the Quérigut biotite-granite has an intrusive character at its northern contact, where it caused extensive contact metamorphism in Devonian limestones and dolomites, and itself has a contact facies. Minerals described include: biotite (altered into clinozoisite-epidote, titanite, pumpellyite, prehnite and garnet); epidote group minerals (including a variety of clinozoisite with the same pleochroism as thulite); fluorite (uniaxial, —,  $\epsilon$  1.524,  $\omega$  1.556); garnet (mainly grossularite; garnet occurring as alteration product of biotite has  $n$  1.78-1.79 and unit cell  $a$  12.00Å); clinohumite (partly as an intricate homoaxial intergrowth with forsterite), chondrodite, humite (also described by the author in a rock

sample from Katveltorp, Sweden); hydrotalcite and manasseite (alteration products of spinel; hydrotalcite is uniaxial, —,  $\epsilon$  1.496,  $\omega$  1.510); prehnite; pumpellyite (lenses in biotite); spinel ( $n$  1.73, altering to diasporite, amesitic chlorites, and hydrotalcite); talc; xanthophyllite ( $\alpha$  1.644,  $\beta = \gamma$  1.656, nearly uniaxial, —); clintonite: the X-ray powder patterns and optical properties of xanthophyllite and brandisite are identical: in spite of slight chemical differences use of the name brandisite is not warranted. X-ray data are provided for many of the minerals. In the silicate skarns seven zones have been established, based on mineral assemblages. [M.M. 31-703, M.A. 13-560] P. F.

**Ivanov (K. P.)** Иванов (К. П.). О хлорофенте и нижнемезозойских базальтов и долеритов восточного склона Урала. [On chlorophaeite from the Lower Mesozoic basalts and dolerites of the eastern slope of the Urals.] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **120**, 1338-1340, 1 pl.

Recently discovered in the Urals Mesozoic basic lavas and sills are very rich in interstitial and amygdaloidal chlorophaeite, which is considered to be a primary magmatic mineral. Three chemical analyses and optical data for various varieties are given.

				<i>n</i>	SiO <sub>2</sub>	TiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	FeO
A	Green isotropic			1.555	43.14	0.08	8.33	7.94	11.06
B	Yellow and green isotropic			1.539	45.66	1.56	8.32	11.05	6.72
C	Greenish-yellow weakly crystallized			1.538	45.60	0.26	7.58	10.82	6.48
	MnO	MgO	CaO	Na <sub>2</sub> O	K <sub>2</sub> O	CO <sub>2</sub>	H <sub>2</sub> O+	H <sub>2</sub> O—	Total
A	0.29	17.78	0.39	0.96	0.47	0.44	7.97	9.89	'100.73'
B	0.09	12.83	3.74	2.78	0.11	2.28	8.03	4.86	'99.99'
C	0.04	17.32	1.46	1.52	0.28	Ign. loss = 8.28			'100.27'

[Totals quite wrong. ? should H<sub>2</sub>O+ be omitted, and H<sub>2</sub>O— read H<sub>2</sub>O±.] S. I. T.

**Stone (P.) & Brown (G. M.).** *The Quihita-Cunene layered gabbroic intrusion of south-west Angola.* Geol. Mag., 1958, **95**, 195-206, 3 figs., 1 pl.

A preliminary account, based on a detailed traverse, of a layered basic intrusion, comparable in many respects with the Great Dyke of Southern Rhodesia. It exhibits cryptic and rhythmic variation indicative of crystal fractionation and accumulation under gravity. The plagioclase varies from An<sub>75-80</sub> in the marginally exposed, or lowest rocks, to An<sub>50</sub> in the centrally exposed, or highest rocks, and the olivine varies correspondingly from Fa<sub>16</sub> to approximately Fa<sub>35</sub>. Both clinopyroxene and orthopyroxene are also present.

W. J. W.



**Drever (H. I.).** *A note on the occurrence of rhythmic layering in the Eilean Mhuire sill, Shiant Isles.* Geol. Mag., 1957, **94**, 277–280, 1 pl.

Plagioclase and clinopyroxene are the principal minerals involved in rhythmic layering and igneous lamination in the Eilean Mhuire sill. Analysis of a clinopyroxene from a pyroxene-rich layer gave  $\text{SiO}_2$  50.29,  $\text{Al}_2\text{O}_3$  1.47,  $\text{TiO}_2$  1.23,  $\text{Fe}_2\text{O}_3$  1.03,  $\text{FeO}$  11.75,  $\text{MnO}$  0.25,  $\text{MgO}$  12.47,  $\text{CaO}$  21.07,  $\text{Na}_2\text{O}$  0.49,  $\text{K}_2\text{O}$  tr.,  $\text{H}_2\text{O}-$  0.05,  $\text{H}_2\text{O}+$  0.27, [=100.37], and Ga 5, Cr 10, V 300, Li nil, Ni 10, Co 35, Sc 75, Zr 90, Y 55, Sr 20 p.p.m. [M.A. 12-418] W. J. W.

**Carstens (Harald).** *On the orbicular structure in the norite of Romsaas, Norway.* Norsk Geol. Tidsskr., 1957, **37**, 279–280.

The orbs of the Romsaas orbicular norite contain radially arranged hypersthene as do small individual groups in the ordinary quartz-norite. It is suggested that strong turbulent motion in a magma may be favourable for the orientation of the hypersthene in the norites, with the development of a spheroidal texture. R. A. H.

**Brindley (J. C.).** *The geology of the northern end of the Leinster Granite: Part 1—Internal structural features.* Proc. Roy. Irish Acad., 1954, **56B**, 159–190, 6 figs., 3 pls.

Three types of granite are recognized in which schlieren and mineral parallelism define a well-marked flow pattern. Type I is fine-grained and granodioritic, locally associated with a migmatitic marginal facies, and gradational to the other types. Type II is a porphyritic microcline granite with good flow structures found marginal to and in the roof zone of type III, a central porphyritic muscovite granite. Late stage deuteric effects and waning flow movements account for the mineralogy and fabric of type III. A detailed sequence is given relating the pegmatite-aplite fracture phase to the last stages of intrusive movements, a still plastic envelope limiting this phase to the granite, and the later phase of mineral veins and sheared border zones of the granite to regional orogenic stresses. J. P.

**Tryggvason (T.).** *The gabbro bombs at lake Graenavatn.* Bull. Geol. Inst. Uppsala, 1957, **38**, 1–5, 1 fig.

Volcanic bombs representing a light gray medium-grained olivine-gabbro are described. They are found on the shores of the maar lake Graenavatn on the Reykjanes

Peninsula of Iceland. The olivine-gabbro shows relatively large crystals of plagioclase enclosed in large pyroxene crystals. The olivine is of normal basaltic type with about 30 mol.% fayalite. Optical determinations of the plagioclase gave between 79 and 85% anorthite. This corresponds with two separate chemical analyses showing 80.2 and 80.0% anorthite respectively. E. Å-n.

**Redaelli (L. L.).** *A petrological investigation in Lake Norra Dellen by means of frog-man equipment.* Sveriges Geol. Unders., 1957, ser. C, **548**, 1–22, 16 figs.

The geology of the volcanic region of Lake Dellen is not well known because of the lack of sufficient outcrops. Frog-man equipment was therefore used in order to examine the outcrops on the bottom of the lake, down to depths of 53 metres. The procedure for this under-water exploration is described. The boundaries of the area covered by volcanic material, 44 sq. km, could be mapped by this method. Petrographic description is given of tuffs, devitrified andesite, and glassy andesite, together with 7 photomicrographs and 4 chemical analyses. P. Lggn.

**Hjelmqvist (S.).** *On the occurrence of ignimbrite in the Pre-Cambrian.* Sveriges Geol. Unders., 1956, ser. C, **542**, 1–12, 12 figs.

The author mentions the characteristic features of the ignimbrites (welded tuffs) and discusses the eutaxitic porphyries of the Pre-Cambrian of Dalarna and adjoining parts of South Härjedalen in Central Sweden. The agreement with the characteristic features of younger welded tuffs is so clear that there seems to be little doubt of the ignimbritic origin of these eutaxitic porphyries. E. Å-n.

**Patterson (E. M.).** *The Tertiary volcanic succession in the western part of the Antrim Plateau.* Proc. Roy. Irish Acad., 1955, **57B**, 155–170, 3 pls.

The lava succession is described in detail; it is suggested that the flows are equivalent in time to the Upper Series of north Antrim. Sub-basaltic bole at Downhill and the Coagh Conglomerate support this correlation. The occurrence of picrite-basalts is noted from boreholes and analyses are given. J. P.

**Patterson (E. M.).** *The Tertiary lava succession in the northern part of the Antrim Plateau.* Proc. Roy. Irish Acad., 1955, **57B**, 79–122, 3 figs., 5 pls.

Details are given of the thickness, granularity, mode,

chemical analysis, and norm of the lavas. Three lava series are recognized separated by two interbasaltic horizons. The lower series varies greatly in thickness over a faulted land surface with localized initial explosive activity. Flows are of pahoehoe type and similar to the Porphyritic Magma Type of Mull. Olivine frequently occurs in two generations and plagioclase may be seen as phenocrysts. The middle series are basalts of Causeway type and free from olivine; seven flows are identified, one showing an unusually low potash content and containing some olivine. They are compared with the Non-porphyritic Central Magma Type of Mull. The upper series differ from the lower flows only in being thicker and more massive and usually in having olivine porphyritic. New chemical and mineralogical analyses are given for the interbasaltic rocks the horizons of which coalesce as the middle lava series wedges out into the single interbasaltic horizon of Antrim. J. P.

[**Lyakhovich (V. V.)**] Ляхович (В. В.). К минералогии палагонитов. [*On the mineralogy of palagonites.*] Минер. Сборник Львовского Геол. Общ. [Min. Mag. Lvov Geol. Soc.], 1957, no. 11, 193–222, 12 figs.

Palagonitic amygdaloidal gabbro-diabases belonging to the 'Siberian Traps' formation, from the river Alymzhakh, Yakutian region, are described. Palagonite in these rocks occurs as amygdules and in the groundmass. In one of the specimens palagonite occurs in the form of drop-like inclusions in the interstitial glass. A sample of a pitch-black, brittle palagonite on analysis gave  $\text{SiO}_2$  38.72,  $\text{Al}_2\text{O}_3$  6.04,  $\text{Fe}_2\text{O}_3$  23.74,  $\text{FeO}$  4.74,  $\text{MgO}$  4.00,  $\text{CaO}$  3.31,  $\text{H}_2\text{O}+$  13.08,  $\text{H}_2\text{O}-$  6.19,  $\text{TiO}_2$  0.30,  $\text{MnO}$  0.56, = '100.60', sp. gr. 1.603, refr. ind. 1.469. A comparative study is made of palagonite, chlorophaeite, and similar substances as described in the U.S.S.R. and elsewhere. The occurrence of palagonite as droplets enclosed in glass, deformed palagonite amygdules, and other features suggest that palagonite is a product of magmatic liquation and is not a late product of hydration of glass. On the other hand the interstitial palagonite may be considered to be a late magmatic product formed from a water-enriched magmatic residue which first consolidated as an amorphous colloidal gel and later recrystallized. S. I. T.

[**Grosvald (M. G.)**] Гросвальд (М. Г.). Восточно-Тувинский район четвертичных вулканов. [*The East Tuva region of Quaternary volcanoes.*] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1958, 122, 449–452, 3 figs.

In 1945 S. V. Obruchev discovered basalts in the eastern Tuva. The author's recent survey of the region between the rivers Bii-Khem (Bolshoi Enisey) and Khamsyn revealed the presence of eleven shield volcanoes, four strato volcanoes, and four slag cones situated among extensive pyroclastic deposits and confluent lava flows. The volcanoes are aligned along SW-NE tectonic fractures.

S. I. T.

**Banfield (A. F.), Behre (Chas. H., Jr.), & St. Clair (David)** *Geology of Isabela (Albemarle) Island, Archipelago de Colon (Galapagos).* Bull. Geol. Soc. America, 1956, 67, 215–234, 4 figs., 4 pls. (aerial photographs).

The entirely volcanic features of Isabela, the largest island of the Galapagos, are described. All the rocks studied were basalts, relatively high in magnetite and low in pyroxenes and olivine: basaltic tuffs and agglomerates occur in addition to flows. Two chemical analyses of basalt and one of basaltic tuff are given. Steam or sulphurous solfataras occur in the craters of three of the five main volcanoes: around the sulphurous vents the lava is altered to a white claylike material. The sulphur deposits contain S 98.61, As 0.001, and Sb 0.002, the remainder probably being moisture and dust. R. A. H.

**Macdonald (G. A.) & Eaton (J. P.).** *Hawaiian volcanoes during 1954.* Bull. U.S. Geol. Survey, 1957, no. 1061-B, 17–72.

The only eruption of Kilauea, which caused no apparent reduction in magmatic pressure beneath the volcano, took place on May 31. Throughout the rest of the year the pressure slowly continued to increase. Mauna Loa remained quiet throughout the year. K. S.

**Searle (E. J.).** *A vitreous sedimentary bomb from pyroclastic material at Auckland, New Zealand.* Trans. Roy. Soc. New Zealand, 1950, 78, 479–481, 3 figs.

Mullite is found to be copiously developed in a vitrified bomb of sedimentary origin. Mean refr. ind. 1.655,  $r > v$  fairly strong. For the glass matrix,  $n$  1.513–1.523.

D. S. C.

**Speight (R.).** *The geology of Banks Peninsula—a revision. Part II. The Akaroa volcano.* Trans. Roy. Soc. New Zealand, 1944, 74, 232–254, 6 pls.

The geology of the Akaroa volcano is reviewed; it is latest Tertiary or early Pleistocene in age. Six analyses are given of basaltic rocks and two of trachytes. D. S. C.



**Hayes (F.).** *A provisional reclassification of granite.* Geol. Mag., 1957, **94**, 58–68, 4 figs.

The granites are sub-divided into classes, based on the proportions of plagioclase and alkali feldspar, and further into sub-classes according to the dominance ratio of quartz : alkali feldspar : plagioclase. The colour index and biotite/muscovite ratio is also applied. Symbols are proposed for the classes and sub-classes. For example, the symbol  $mIP_{10}$  is used for a rock with <5% muscovite, 5 to 10% biotite, plagioclase > quartz > alkali feldspar, and with an excess of plagioclase over alkali feldspar less than two-fold. [M.A. 13–527] G. M. B.

**Luang (W. T.).** *Riebeckite granite in the Wichita Mountains, Oklahoma.* Bull. Geol. Soc. America, 1958, **69**, 1191–1192, 1 pl.

The petrography of a riebeckite granite, which has not been reported in previous reports on the Wichita Mountains, is described. A. L. A.

**Willey (C. E.).** *A note on the pitchstones of Arran.* Geol. Mag., 1957, **94**, 329–333, 1 fig.

A note on the incipient crystallization of biotite (newly recorded), hornblende, and clinopyroxene in the groundmass of some Arran pitchstones, and a discussion relating the chemical composition of pitchstones to experimental work on the system  $NaAlSi_3O_8$ – $KAlSi_3O_8$ – $SiO_2$  at 1000 kg/cm<sup>2</sup> water vapour pressure. W. J. W.

**Lundegårdh (P. H.).** *The titaniferous ore-bearing gabbro of Helsingland, Central Sweden.* Sveriges Geol. Unders., 1957, ser. C, **549**, 1–34, 16 figs.

In the primorogenic granite of Helsingland in the area of Färvsö some deposits of titaniferous ore-bearing gabbro are met. This gabbro is older than the surrounding primorogenic granite. The gabbro seems to have intruded along the S-planes of the supracrustal formation during an early phase of the primorogenic folding. The normal titaniferous gabbro is a common gabbro grading into norite. The oxidic ore consists of magnetite and ilmenite. A general sample from the top level of the ore zone shows 5.98%  $TiO_2$ , 13.28%  $Fe_2O_3$ , 19.40%  $FeO$ , 0.32%  $V_2O_5$ , and traces of  $Cr_2O_3$ . The author also gives a geochemical review of the contents of Ti, V, Cr, Mn, Co, and Ni in the gabbro of Central and Northern Helsingland as well as in various Swedish norites and hyperites. E. Å.-n.

**Legraye (M.).** *Quelques observations sur les pegmatites de la région de Kabunga (Kivu, Congo belge).* Ann. Soc. Géol. Belgique, 1954–55, **78**, fasc. spéc., 31–40, 4 figs.

Observations on the geological relations of the pegmatites and their zonary distribution, with descriptions and classification of some types. J. M.

**Wilcox (Ronald E.) & Poldervaart (Arie).** *Metadolerite dike swarm in Bakersville-Roan Mtn. area, North Carolina.* Bull. Geol. Soc. America, 1958, **69**, 1323–1368, 17 figs., 3 pls.

A Pre-Cambrian metadolerite dike swarm, emplaced in Cranberry gneiss, loses its identity in the hornblendic Roan gneiss. Ortho-amphibolites exposed near Tolcane in the boundary zone between the Aranberry and Roan formations are associated with and grade into metadiorite. Magnetic polarization and susceptibility data are given for 10 dike rocks. Chemical analyses of 22 rocks are given as well as modal analyses and optical data for the constituent minerals of 19 of these. Two hundred and thirty-five meta-dolerites, ortho-amphibolites, and para-amphibolites from the area were analysed semi-quantitatively for Ga, Cu, Cr, Ni, Co, Ba, and Sr. Twenty-three quantitative spectrographic analyses for Sr are also given. Chemically the dike rocks are typical olivine dolerites belonging to the middle- and late-stage basalts of Wager. However, the present texture and mineralogy is due to metamorphism of the amphibolite facies. The ortho- and para-amphibolites cannot be distinguished by their bulk chemical composition nor by their contents of Cu, Ga, Ba, Ni, Co, or Cr, but may possibly be distinguished by the lower Sr content of the para-amphibolites. Two chemical analyses indicate that strongly clouded plagioclase contains more FeO than lightly clouded plagioclase. Differences in textures of the rocks are attributed to differences in water content during recrystallization at essentially the same temperature and pressure. Amphibolite problems are reviewed briefly. A. L. A.

**Gass (I. G.).** *Ultrabasic pillow lavas from Cyprus.* Geol. Mag., 1958, **95**, 241–251, 1 fig.

Two types of ultrabasic rock containing a high proportion of olivine phenocrysts are associated with basaltic pillow lavas in the northern foothills of the Troodos mountains. A vitrophyric type (A), occurring as pillow lavas and intrusive bodies, contains a modal average of 56.9% of fresh olivine phenocrysts,  $\alpha$  1.646,  $\beta$  1.665,  $\gamma$  1.685,  $2V$ , 88°, partial analysis:  $SiO_2$  42.4,  $FeO$  7.7,  $MgO$  49.9. A holocrystalline type (B) is always intrusive, and contains

approximately 45% (modal) of extensively serpentinized olivine phenocrysts (biaxial +). It is suggested that these rocks may have formed from a peridotite melt.

	SiO <sub>2</sub>	TiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	FeO	MnO	MgO	CaO
A	43.00	0.18	4.64	2.42	6.47	0.15	33.45	3.99
B	42.11	0.23	6.59	3.62	5.38	0.16	30.00	3.39

	Na <sub>2</sub> O	K <sub>2</sub> O	H <sub>2</sub> O+	H <sub>2</sub> O—	Cr <sub>2</sub> O <sub>3</sub>	P <sub>2</sub> O <sub>5</sub>	NiO	Total
A	0.25	0.05	3.83	1.22	0.51	—	—	100.16
B	0.25	0.17	6.05	1.89	0.28	0.05	0.12	100.29

W. J. W.

**Tilley (C. E.).** *The leucite nepheline dolerite of Meiches, Vogelsberg, Hessen.* Amer. Min., 1958, **43**, 758–761, 1 fig., 1 table.

Application of a new analysis (A) of this leucite nepheline dolerite to the system NaAlSiO<sub>4</sub>–KAlSiO<sub>4</sub>–SiO<sub>2</sub> enables corroboration of the order of crystallization by both phase diagram principles and textural interpretation of rock samples. Complete analyses are given for nepheline (B) and sanidine (Or<sub>73.0</sub>Ab<sub>22.9</sub>An<sub>0.3</sub>Cn<sub>3.8</sub>) (C). A leucite fraction contains K<sub>2</sub>O 19.42 and Na<sub>2</sub>O 1.12%: anal. J. H. Scoon.

	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	FeO	MgO	CaO	Na <sub>2</sub> O	K <sub>2</sub> O
A	43.18	20.72	2.39	5.21	3.22	8.00	7.65	5.07
B	42.28	33.71	0.80		0.03	0.56	16.61	5.75
C	63.62	19.12	0.47		0.05	0.05	2.66	12.09

	H <sub>2</sub> O+	H <sub>2</sub> O—	TiO <sub>2</sub>	P <sub>2</sub> O <sub>5</sub>	MnO	BaO	CO <sub>2</sub>	Total
A	0.67	0.42	2.90	0.42	0.13	0.12	0.08	100.18
B	0.34*	0.03	0.07	—	—	—	—	100.18
C	0.11*	nil	0.08	—	—	1.56	—	99.81

\* loss on ignition.

B. H. B.

[**Eskin (A. S.)**] Ескин (А. С.). Биотитовый авгитит Ушканских островов (озеро Байкал). [*Biotite augitite from the Ushkanyi islands (Lake Baikal).*] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **122**, 1098–1099.

Biotite augitite is a dark fine-grained intrusive igneous rock composed of glass (50–70 volume per cent.), pyroxene phenocrysts, biotite (up to 5%), and little olivine. Pyroxenes are often zoned and some have an hour-glass structure, brown colour,  $c:\gamma$  53°, 2V+56°. Analysis of the rock gave SiO<sub>2</sub> 41.48, Al<sub>2</sub>O<sub>3</sub> 13.96, Fe<sub>2</sub>O<sub>3</sub> 5.23, FeO 7.33, MgO 11.22, CaO 10.16, Na<sub>2</sub>O 1.22, K<sub>2</sub>O 1.94, H<sub>2</sub>O+ 3.18, H<sub>2</sub>O— 0.34, TiO<sub>2</sub> 2.17, MnO 0.18, = '99.90'. S. I. T.

**Rothstein (A. T. V.).** *The Dawros peridotite, Connemara, Eire.* Quart. Journ. Geol. Soc. London, 1957, **113**, 1–25, 2 figs., 5 pls.

A Pre-Cambrian ultramafic complex, together with the surrounding regional metamorphic rocks, has been mapped

and studied petrologically in detail within a small area  $\frac{1}{2} \times \frac{1}{4}$  mile. The intrusion is in the form of a lens, 500 ft thick, with a rim of massive harzburgite and a core of layered rocks. The latter consist of varied assemblages of olivine, clinopyroxene, orthopyroxene, and chromite spinel, and show evidence of formation by rhythmic crystal accumulation. Optical data are given for the full range of pyroxenes while chemical analyses of selected pyroxenes are discussed, but not presented. The orthopyroxene change upwards from Ca<sub>1.2</sub>Mg<sub>90.3</sub>Fe<sub>8.5</sub> to Ca<sub>1.0</sub>Mg<sub>85.6</sub>Fe<sub>13.4</sub>, while the clinopyroxenes change from Ca<sub>44.9</sub>Mg<sub>50</sub>Fe<sub>5.1</sub> to Ca<sub>45.2</sub>Mg<sub>47.8</sub>Fe<sub>7.3</sub>. The mass is believed to have been deformed and recrystallized after consolidation but whilst still hot, and metamorphic textures are superimposed upon relict igneous textures. G. M. B.

**de Béthune (Pierre) & Meyer (André).** *Les carbonatites de la Lueshe (Kivu, Congo Belge).* C. R. Acad. Sci. Paris, 1956, **243**, 1132–1134.

This alkaline mass, about 50 km distant from the principal volcanoes of the potassic province of Virunga, is composed mainly of two rocks, calcite cancrinite syenite (busorite) and aegirine carbonatite (ringite). The cancrinite and calcite are of primary origin. Metasomatic transformations occur in the surrounding schists. E. J. & A. S.

**de Béthune (P.).** *Caractères pétrographiques des carbonatites de la Lueshe (Kivu, Congo Belge).* Ann. Soc. Géol. Belgique, 1956–57, **80**, B, 63–66.

These rocks are ringites (with aegirine, sometimes not pleochroic), sövites (with lepidomelane), or belong to a type of borgniezite (with sodic amphibole). [M.M. **31**–954] J. M.

**Howie (R. A.).** *African charnockites and related rocks.* Serv. Géol. Congo Belge, 1958, Bull. **8**, fasc. 2, 16 pp.

The occurrences of Pre-Cambrian rocks, with affinities with the charnockite series, from the Belgian Congo [M.A. **13**–677] Uganda, Natal [M.A. **9**–169], Sudan, Madagascar, and the central Sahara are reviewed, and new petrographic and spectrochemical data are presented for the Sudan rocks. Chemical analyses are given for hypersthene A from hypersthene gneiss, Bemato, Madagascar; hypersthene B from hypersthene gneiss, Fort Dauphin, Madagascar; eulite C (2V<sub>a</sub>78°) from charnockitic adamellite, Oribi Gorge, Marble Delta, Natal; and for a basic rock from Lafit Mountains (4° 40' N., 32° 49' E.), Sudan, and its ferrohypersthene D, augite E, and olive brown hornblende F.



SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	TiO <sub>2</sub>	Fe <sub>2</sub> O <sub>3</sub>	FeO	MnO	MgO	CaO	Na <sub>2</sub> O	K <sub>2</sub> O	H <sub>2</sub> O+	H <sub>2</sub> O-	Total	$\alpha$	sp. gr.
49.52	2.86	0.15	0.62	26.31	0.23	18.10	0.96	A	tr.	nil	0.70	0.27	99.72	1.726
50.21	2.52	0.12	1.93	26.10	0.70	17.80	0.66	B	0.02	tr.	0.04	0.02	100.12	1.725
46.65	2.10	0.10	0.57	44.02	0.55	4.90	0.81	C	0.01	0.01	0.08	0.03	99.83	1.763
49.98	2.26	0.18	1.05	27.97	0.60	15.82	1.81	D	0.11	0.07	n.d.	0.21	100.06	1.725
50.32	2.84	0.38	2.84	10.84	0.25	11.53	20.65	E	0.49	0.07	n.d.	0.07	100.28	1.714
41.96	13.06	2.10	3.20	14.12	0.16	8.98	11.72	F	1.46	1.48	1.71	0.13	100.08	1.681

W. S. M.

## TOPOGRAPHICAL MINERALOGY

**edlicka (John F.) & Pelletier-Doisy (Charles).** *A visit to Almaden, Spain.* Rocks and Minerals, 1958, **33**, 411-412, 1 fig.

A brief account of a visit to the mercury deposits at Almaden, Spain, is given. The major producing deposits are summarized and some data on reserves and production are presented.

R. S. M.

**Vilson (Clarence).** *Epidote near Bakersville, N.C.* Rocks and Minerals, 1958, **33**, 344, 1 fig.

Doubly terminated green epidote crystals up to 6 inches long are found with white platy albite crystals about 5 miles north-east of Bakersville, Mitchell County, North Carolina.

R. S. M.

**Allen (Mrs. Fred).** *Radioactive minerals in North Carolina.* Rocks and Minerals, 1958, **33**, 328-329.

This partial list of radioactive minerals to be found in North Carolina includes descriptions of allanite, auelite, autunite, cyrtolite, euxenite, gadolinite, gummite, monazite, polycrase, samarskite, torbernite, uraninite, and uranophane.

R. S. M.

**Stuckey (Jasper L.).** *Itacolumite in North Carolina.* Rocks and Minerals, 1958, **33**, 324-325.

Itacolumite (flexible sandstone) occurs in: (1) the Sauratown Mountains of Stokes County, (2) the Kings Mountain district of Cleveland and Gaston Counties, and (3) south of Linville Falls in Burke County. The rocks from these occurrences are described and several papers on these localities, published approximately 100 years ago, are listed.

R. S. M.

**Ray (James A.).** *Minerals of the pegmatites of Crabtree, Mitchell County, North Carolina.* Rocks and Minerals, 1958, **33**, 291-300, 6 figs.

Three workings in the area are described. Only those minerals which have been seen by the writer are mentioned.

Crabtree Emerald Mine: emerald (grass-green), beryl (yellow and yellow-green), schorl, biotite, quartz. McKinney Mine: samarskite, columbite, monazite, torbernite, hyalite, sphalerite, uranophane, chalcopyrite, uraninite, beryl, mica (greenish A type), garnets (bright orange to red), feldspar. The \$20 Mine: cyrtolite, uraninite, monazite, gummite, clarkeite, thulite, allanite, calcite (red fluorescence), hyalite.

R. S. M.

**Gooch (Edwin O.).** *Vermiculite.* Virginia Minerals, 1957, **3**, 1-6, 3 figs.

The occurrences of vermiculite in Virginia are described and plotted on a map.

R. S. M.

**Ingle (Don).** *Barite locations in Colorado.* Rocks and Minerals, 1958, **33**, 440.

A partial listing of the known localities for baryte in Colorado.

R. S. M.

**Giannini (William F.) & Sherwood (W. Cullen).** *Large calcite crystals from Staunton, Virginia.* Rocks and Minerals, 1958, **33**, 413-414, 4 figs.

Well-developed calcite crystals, up to 6 inches parallel to the  $a$  crystallographic axis, occur near Staunton, Virginia, in a quarry in the Beekmantown limestone. The crystals are clear, white, yellow, brown, red, or nearly opaque dark gray. Zoning and phantom growths are common features of the specimens. Pyrite inclusions on phantom rhombohedrons form star-like features. In addition to the common rhombohedron {011 $\bar{2}$ }, scalenohedrons, prisms, and other rhombohedrons occur.

R. S. M.

**Shaub (B. M.).** *The quartz crystal pocket discovered on Deer Hill, Maine.* Rocks and Minerals, 1958, **33**, 407-410, 2 figs.

Approximately 1500 to 2000 pounds of quartz crystals were removed from a pocket 7 by 4 by 3½ feet located

22 feet below the surface of Eastman ledge pegmatite. The pocket, filled with kaolinite, contained crystals up to 14 inches long. Although some are amethystine, most are smoky quartz characterized by white porcelain-like surfaces on the rhombohedral faces. Occasionally the prism faces show a slight and variable deposition of white quartz. Frequently several smaller crystals are clustered about a central crystal.

R. S. M.

**Abdulla (M. A.).** *Annual report for the period July 1955 to June 1957.* Republic of the Sudan, Geol. Surv. Dept., 21 pp., 1 pl.

Brief reports are given on the various areas mapped

during the period, together with notes on the economic minerals encountered which include asbestos, gold, magnetite, limonitic oolite, mica, vermiculite, wollastonite, and large talc-magnesite deposit.

R. A. H.

**Elston (Wolfgang E.).** *Geology and Mineral Resources of Dwyer Quadrangle, Grant, Luna, and Sierra Counties, New Mexico.* Bull. New Mexico Bur. Mines and Mineral Resources, 1957, **38**, 1-78, 8 pls., 8 figs.

Investigation primarily of the petrology and geological history of the volcanic rocks (7 new chem. anal.) in Dwyer Quadrangle of south-western New Mexico. Included is a brief description of the fluorite-quartz deposits in the area.

D. H. R.

## VARIOUS TOPICS

**De Vore (George W.).** *The association of strongly polarizing cations with weakly polarizing cations as a major influence in element distribution, mineral composition, and crystal growth.* Journ. Geol., 1957, **65**, 178-195, 2 figs.

The distribution of major elements between coexisting silicates is examined for the mineral pairs ortho- and clinopyroxene, hornblende and pyroxene, biotite and pyroxene, and hornblende and biotite. The fixation of large numbers of foreign strongly polarizing cations to the mineral by the weakly polarizing cations results in compositional changes in the other constituents of the mineral. The possibilities that certain compositions of hornblende and biotite are ordered compounds with respect to Si and 4-coordinated Al, and that orthopyroxene of composition  $\text{En}_{50}\text{Fs}_{50}$  is an ordered compound with respect to Mg and  $\text{Fe}^{11}$  are discussed. A model for calculating the mineral composition so as to remove the influence of the foreign constituents is proposed. [M.A. **11-390**, **12-27**, **13-277**, **282**] R. A. H.

**Jensen (M. L.).** *Sulfur isotopes and mineral paragenesis.* Econ. Geol., 1957, **52**, 269-281, 6 figs.

A study of  $^{32}\text{S}/^{34}\text{S}$  ratios obtained from two or more sulphides in the same hand specimen indicates appreciable variations. Such variations may enable a distinction to be made between exsolution and replacement textures. It is suggested that the mechanism of replacement of one sulphide by another is not always a diffusion mechanism of the small metal cations but also includes an exchange of the sulphur anions: hypogene ore fluids may vary in

isotopic composition, in addition supergene and hypogene minerals may be distinguishable by isotopic analyses. [M.A. **11-264**, **12-100**, **559**, **13-332**, **343**] R. A. H.

**Bárta (Rudolf).** *Názvosloví a akronymy termografické [Nomenclature and abbreviations of thermography]* Silikáty, **1**, no. 2, 191-192.

A proposal for uniform nomenclature and abbreviations in thermography is published, worked out by members of a committee. It is designed for research workers in Czechoslovakia.

J. K.

**Barrer (R. M.) & Meier (W. M.).** *Structural and ion sieve properties of a synthetic crystalline exchanger.* Trans. Faraday Soc., 1958, **54**, 1074-1085, 2 pls.

A synthetic crystalline ion exchange zeolite (Linde Molecular Sieve A) has a composition approximating to  $\text{Na}_{12}\{12\text{AlO}_2 \cdot 12\text{SiO}_2\}\text{NaAlO}_2 \cdot 29\text{H}_2\text{O}$ . Structurally it is composed of large  $\alpha$ -cages, smaller  $\beta$ -cages of the type found in sodalite, and very small cubic cages; these cages being built of  $\text{AlO}_4$  and  $\text{SiO}_4$  tetrahedra. The cubic pseudo unit cell has  $a=12.273\text{kX}$ , but the true cubic unit cell has twice this dimension. Exchanges involving various ions are reported.

R. A. H.

**MacDonald (Gordon J. F.).** *Thermodynamics of solids under non-hydrostatic stress with geologic applications.* Amer. Journ. Sci., 1957, **255**, 266-281, 3 figs.

The thermodynamics of elastic bodies following Gibbs' treatment is presented, and it is concluded that it is



oretically impossible for a phase to be stable only under conditions of non-hydrostatic stress. It is shown that the shape of the equilibrium curve relating temperature and pressure in a stressed solid will be almost the same as in the case of hydrostatic pressure for transitions in which entropy and volume change are large compared with the terms involving stress differences and elastic constants; a transition from andalusite to kyanite should not be affected by shearing stress but stress might affect the equilibrium curve between andalusite and sillimanite.

W. S. M.

**Seibach (Rudolf).** *Thermodynamic behavior of quartz and other forms of silica in pure water at elevated temperatures and pressures with conclusions on their mechanism of solution.* Journ. Geol., 1957, **65**, 347-363, 7 figs.

The solution mechanism of low-temperature quartz is viewed using previously published data. At elevated temperatures and pressures the mechanism corresponds to a bimolecular heterogeneous gas reaction, its equation being  $\text{SiO}_2 + 2\text{H}(\text{OH}) \rightleftharpoons [\text{Si}(\text{OH})_4]$ : silica is dispersed at first as molecules, probably to ions. From 200°C to 1000°C, and pressures up to 20,000 bars, the solubility of low-temperature quartz is reproduced by the formula  $(\text{SiO}_2) = D^2e^{(Q/RT + h)}$ , in which  $Q$  signifies the differential solution enthalpy of low-temperature quartz in water and has the value -9,470 cal./mole  $\text{SiO}_2$ ,  $h = 0.362$ . The experimental results of Frederickson & Cox [M.A. 12-523], which are partly contradictory to the proposed mechanism, are critically examined. [M.A. 6-378, 6-24, 10-104, 11-86, 12-49, 446]

R. A. H.

**Ellis (A. J.).** *Chemical equilibrium in magmatic gases.* Amer. Journ. Sci., 1957, **255**, 416-431, 3 figs.

The systems  $\text{H}_2\text{O}-\text{S}_2$ ,  $\text{H}_2\text{O}-\text{S}_2-\text{H}_2$ ,  $\text{H}_2\text{O}-\text{S}_2-\text{O}_2$ , and  $\text{H}_2\text{O}-\text{CO}_2-\text{S}_2-\text{H}_2$  are considered from a theoretical standpoint using the approximate proportions of the elements present in magmatic gases. The agreement between the theoretical compositions of magmatic gases at different temperatures and pressures and the observed compositions is an indication that magmatic gases approach a state of chemical equilibrium. [M.A. 7-448, 8-31]

W. S. M.

**Verhoogen (Jean).** *Thermodynamics of a magmatic gas phase.* Univ. Calif. Publ. Geol. Sci., 1949, **28**, no. 5, 91-136.

The development and composition of a magmatic gas phase, the order of deposition from such a phase, variation of the cooling vapor pressure of a cooling magma and the influence of non-uniform pressures are treated in a rigorous thermodynamic fashion. This largely mathematical discussion is followed by a 5-page summary devoid of equations.

A. P.

**Gaines (George L., Jr.).** *The ion-exchange properties of muscovite mica.* Journ. Physical Chem., 1957, **61**, 1408-1413.

The ion-exchange capacity of a high quality "Bengal Ruby" muscovite mica has been studied by a variety of methods, and a chemical analysis of the mica used is given. Exchange proceeds readily with the natural potassium ions on exposed cleavage surfaces but little or no penetration or attack on the crystal structure occurs in dilute neutral aqueous solutions at room temperature. The exchange capacity is directly proportional to the exposed surface area and is in reasonable agreement with the value calculated from the crystal structure parameters.

R. A. H.

**Kissinger (Homer E.).** *Reaction kinetics in differential thermal analysis.* Anal. Chem., 1957, **29**, 1702-1706, 6 figs.

The effects of the kinetics of reactions of the type solid  $\rightarrow$  solid + gas on the corresponding d.t.a. pattern are explored. The d.t.a. curves of magnesite, calcite, brucite, kaolinite, and halloysite are examined and it is concluded that the d.t.a. results agree with results obtained isothermally, except in some specific cases.

R. A. H.

**Allen (Robert D.).** *Differential thermal analysis of selected borate minerals.* Bull. U.S. Geol. Survey, 1957, **1036-K**, 193-208, 10 figs.

A portable apparatus was used to give d.t.a. curves for bakerite, borax, colemanite, ginorite, howlite, kernite, meyerhofferite, priceite, probertite, sassolite, searlesite, tincalconite, and ulexite: the endothermic troughs are listed and the curves figured. The practicability of semi-quantitative analysis of borate minerals by d.t.a. is illustrated by the study of synthetic mixtures of colemanite and ulexite. [M.A. 14-15]

R. A. H.

**Tunell (G.).** *Evaluation of the chemical potential in terms of intensive quantities.* Amer. Journ. Sci., 1957, **255**, 261-265.

Chemical potential must be an intensive quantity since it is equal to a function of intensive quantities viz, specific energy, specific entropy, specific volume, absolute temperature, pressure, and mass fraction of component considered.

G. D. N.

**Garrels (R. M.).** *Some free energy values from geologic relations.* Amer. Min., 1957, **42**, 780-791.

Calculations are presented illustrating the estimation of basic thermochemical data for reactions and compounds of geological interest from mineral associations in surface environments of the earth. Standard free energies of formation from the elements at 25°C and one atmosphere total pressure are, by this method: kaolinite — 883 kcal., muscovite — 1298 kcal, K-feldspar — 856 kcal, hydrocerussite — 406 kcal, and malachite — 217 kcal.

G. D. N.

**Kurath (Sheldon F.).** *Storage of energy in metamict minerals.* Amer. Min., 1957, **42**, 91-99.

Ellsworthite, fergusonite, samarskite, euxenite, and æschynite-priorite were studied by d.t.a. methods, and their radioactivity and the amount of heat evolved on heating under nitrogen were quantitatively determined. Samples of allanite, cyrtolite, gadolinite, and zircon showed no stored heat releaseable below 700°C although they were moderately radioactive; purple fluorite, uraninite, and xenotime had high alpha-ray activity but showed no stored energy, supporting the generalization that highly ionic materials are not found in the metamict state. [M.A. **8**-337, **11**, 436, **12**-173]

R. A. H.

**[Povarennykh (A. S.).]** Поваренных (А. С.). К вопросу о природе растворимости минералов. [On the nature of solubility of minerals.] Зап. Всесоюз. Мин. Общ. [Mem. All-Union Min. Soc.], 1958, **87**, 215-228, 3 figs.

Factors influencing the solubility of minerals are discussed; a scale of solubility in water is constructed for a select list of minerals, and the action of the principal acids on minerals is discussed.

S. I. T.

**Morey (George W.).** *The solubility of solids in gases.* Econ. Geol., 1957, **52**, 225-251, 13 figs.

A summary of the literature is followed by a theoretical discussion of the subject. Binary systems, in which the solubility of a solid in a gas has been shown, are divided into two types: (a) those in which the solubility curve intersects the critical curve, and (b) those in which the solubility curve does not intersect the critical curve. The

experimental results obtained in a number of investigations are discussed: particularly systems in which the gas is steam. New data are provided on the solubility of  $\text{UO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{NiO}$ ,  $\text{Nb}_2\text{O}_5$ ,  $\text{Ta}_2\text{O}_5$ ,  $\text{BeO}$ , and  $\text{GeO}_2$  in superheated steam at 500°C and 1,000 bars pressure.

W. S. M.

**Crowell (A. D.).** *Interaction of rare gases with graphite.* Journ. Chem. Physics, 1957, **26**, 1407-1408.

R. A. H.

**Fabre (Jean).** *Volcanisme dans le permocarbonifère de la zone briançonnaise.* C.R. Acad. Sci. Paris, 1955, **241**, 1795-1798.

Following the discovery of andesitic and rhyolitic lavas at known levels in the Permohouiller [Permocarboniferous] of the Briançon zone, the author attempts a chronology of the volcanic events at the end of the Primary [Palaeozoic] in this zone of the Alps.

E. J. & A. S.

**Duschatko (Robert W.) & Poldervaart (Arie).** *Spilitic intrusion near Ladron Peak, Socorro County, New Mexico.* Bull. Geol. Soc. America, 1955, **66**, 1097-1108.

In a suite of highly altered spilitic rocks from an intrusion in the Yezo formation each metallic element has tended with falling temperatures to form its own mineral or minerals with Si or Al as the only other cations. Deuteric alteration has been accentuated by distillation of hyperfusibles from the country rocks. Fine- to medium-grained albitites are the end products of differentiation; study of zircons indicates a partly magmatic and partly metasomatic origin for these rocks: five chemical analyses are given.

R. A. H.

**Reed (John C., Jr.).** *Catoclin formation near Luray, Virginia.* Bull. Geol. Soc. America, 1955, **66**, 871-896.

The Catoclin formation underlies Lower Cambrian beds and comprises a thick sequence of greenstone and interbedded sediments. Mineralogy, chemical composition, and primary structures indicate that the original lavas were basaltic in composition and were probably normal plateau basalts. Amygdales were well preserved and contain milky quartz, epidote, albite, calcite, and chlorite.

R. A. H.

**Compton (Robert R.).** *Trondhjemite batholith near Bidwell Bar, California.* Bull. Geol. Soc. America, 1955, **66**, 9-44.

Bald Rock batholith is one of a chain of small plutons



0 miles west of the main Sierra Nevada pluton and intrudes an area of greenschist facies rocks into which gabbroic, dioritic, and granitic rocks had earlier been emplaced. The batholith shows gradational zoning from a trondhjemitic core through granodiorite to a heterogeneous tonalite rim which suggests that basic stoped rock contaminated an originally trondhjemitic magma. The contact metamorphic aureole is one to two miles wide and includes rocks of epidote amphibolite to possible pyroxene hornfels facies.

R. A. H.

**Wilson (M. E.).** *Early Precambrian rocks of the Timiskaming region, Quebec and Ontario, Canada.* Bull. Geol. Soc. America, 1956, **67**, 1397-1430, 4 figs., 6 pls. A description is given of the lithological character, structure, and relationship of these rocks in the Canadian shield, which are in the first large area in which the detailed succession of formations has been determined with reasonable clarity. Most of the rocks lie in east-trending belts, with, to the north, a highly folded conformable volcanic succession usually called Keewatin but here named Abitibi Series; to the south, siliceous mica-schist with interbedded volcanics of the Pontiac group, and between these a synclinorium of Timiskaming conglomerate and greywacke. A great structural unconformity separates the Timiskaming sediments from the Abitibi series: the character of the Abitibi lavas does not indicate any difference from volcanic rocks of later age nor that they were related in any way to primitive heat conditions.

R. A. H.

**Hamilton (Warren B.).** *Precambrian rocks of Wichita and Arbuckle Mountains, Oklahoma.* Bull. Geol. Soc. America, 1956, **67**, 1319-1330, 3 figs., 2 pls.

The Precambrian rocks of the Wichita Mountains comprise a stratiform complex in which alumina-poor red granophyre, with related granite and rhyolite, overlies gabbro and anorthosite. The complex is the upper part of a huge gabbroic lopolith formed under quiet conditions: zircon age determinations give a value of about 600 m.y. The Arbuckle Mountains complex is composed mainly of alumina-rich granite ranging to quartz-diorite and probably represents part of a composite batholith formed in an orogenic belt: zircons from the granite indicate an age of 940 m.y.

R. A. H.

**Lund (Ernest H.).** *Igneous and metamorphic rocks of the Minnesota River Valley.* Bull. Geol. Soc. America, 1956, **67**, 1475-1490, 7 pls., 3 maps.

The oldest group of these Precambrian rocks is a basic complex of gabbro and diorite gneiss, quartz-diorite gneiss, and garnetiferous quartz-diorite gneiss. A second group consists of five varieties of granite and granite gneiss while the youngest group includes several small circular gabbroic intrusions, one of which shows pronounced banding or primary flow structure.

R. A. H.

**Fleming (C. A.), Reed (J. J.), & Harris (W. F.).** *The geology of the Snares Islands.* New Zealand Department of Scientific and Industrial Research, Cape Expedition Ser., 1953, Bull. **13**, 42 pp., 19 figs.

In Part I, Fleming describes the general geology of the group and their relationship to other subantarctic islands and southern New Zealand. The main rock type is granite. Seal gastroliths are discussed. In Part II, Reed deals with the petrology of the granites (one analysis), mica-schist, and gastroliths. Part III (by Harris) is concerned with peat samples.

D. S. C.

**Akaad (A. M.).** *The northern aureole of the Ardara pluton of County Donegal.* Geol. Mag., 1956, **93**, 377-392, 1 pl., 2 figs.

A description is given of the country rocks (pelites, limestone, and semipelites) with an account of the outer aureole (deformation plus alteration of chlorite to biotite) and the inner aureole. In the latter an andalusite zone surrounds a sillimanite zone with a thin cordierite sub-zone at the granite contact. Two periods of recrystallisation are distinguished in the petrographic study.

R. St J. L.

**McKie (Duncan) & Burke (Kevin).** *The geology of the islands of South Connemara.* Geol. Mag., 1955, **92**, 487-498, 2 figs.

A description is given of part of the metamorphic envelope on the south side of the Galway granite. The sediments involved (South Connemara Series) include pillow lavas and greywacke and are believed to be Ordovician; the authors suggest a Taconic age for the Galway granite.

S. R. T.

**Akaad (M. Kamal).** *The Ardara granitic diapir of County Donegal, Ireland.* Quart. Journ. Geol. Soc. London, 1956, **112**, 263-290, 8 figs., 2 pls., 1 map.

A circular body, about five miles in diameter and forming the south-west extremity of the Donegal granite, has been mapped in detail and attention paid to the mode of formation and emplacement of the granodiorite, quartz-diorite,

and tonalite components of the pluton. Mapping on a six-inch scale, and of localized areas on an eighteen-inch scale, together with over five thousand observations of small-scale structures form the basis of the investigation. On the basis of structural, rather than chemical and mineralogical evidence, it is inferred that a granodiorite magma reacted with rocks of the Meenalargan amphibolite complex at depth to become a quartz-diorite magma, and that the latter mobilized a derivative of the same complex to form a viscous, plastic skin of tonalite, the two crystallizing to form the nucleus of the pluton. A later surge of granodiorite magma centrally pierced the more basic rocks to complete the general assemblage now exposed.

G. M. B.

**Thomas (Godfrey E.) & Thomas (Trevor M.).** *The volcanic rocks of the area between Fishguard and Strumble Head, Pembrokeshire.* Quart. Journ. Geol. Soc. London, 1956, **112**, 291-314, 8 figs., 1 pl., 1 map.

A detailed description is given of the field characters and general petrographic features of a series of highly variable Llanvirnian volcanic rocks, total thickness ranging from 850 to 3600 ft. The three main divisions of Upper Rhyolite, Pillow-lava, and Lower Rhyolite are described separately, but special attention is paid to the interesting Pillow-lava division in which rocks so diverse as palagonite-tuffs, oligoclase-basalts of Mugeary type, trachybasalts, keratophyres, feldspar sands, and spilitic ash are found intercalated within the dominant pillow-lavas. G. M. B.

**Mitchell (G. H.).** *The Borrowdale Volcanic Series of the Dunnerdale Fells, Lancashire.* Liverpool & Manchester Geol. Journ., 1956, **1**, 428-449, 3 figs., 1 pl., 1 map.

An account, accompanied by a new and detailed map, of the succession and structure of the lower part of the lavas and tuffs, totalling over 8,000 ft. in thickness, of the Ordovician Borrowdale Volcanic Series. Brief notes are given on the petrographic character of the main rock groups.

G. M. B.

**Watters (W. A.).** *The geology of the eastern Hokonui Hills, Southland, N.Z.* Trans. Roy. Soc. New Zealand, 1952, **79**, 467-484, 2 pls., 1 fig.

Zeolitized vitric tuffs of Triassic age are briefly noted.

D. S. C.

**White (Donald E.).** *Violent mud-volcano eruptions of Lake City hot springs, northeastern California.* Bull. Geol. Soc. America, 1955, **66**, 1109-1130, 3 figs., 4 pls.

The spectacular mud-volcano eruption of March 1951 and the character of the fragments erupted are described. A comparison with other mud-volcano areas is made. A mud-volcanic origin, involving only near-surface material and unstable or metastable temperature-depth relations in a high-energy thermal system, is possible for some eruptive deposits classed as phreatic or cryptovolcanic. R. A. H.

**Appledorn (Conrad R.) & Wright (H. E., Jr.).** *Volcanic structures in the Chuska Mountains, Navajo reservation, Arizona-New Mexico.* Bull. Geol. Soc. America, 1957, **68**, 445-468.

The Pliocene volcanic rocks of Chuska Mountains are mainly minette or its extrusive equivalent alkalic sanidine trachybasalt. Five volcanic centres were examined in detail and their eruptive and structural histories determined. The volcanism was explosive in its early stages and large quantities of pyroclastic material were ejected in numerous phreatic explosions. Volcanic activity ended with quiet extrusion of viscous lava and intrusion of dykes and plugs.

R. A. H.

**Lovering (T. S.).** *Halogen-acid alteration of ash at fumarole No. 1, Valley of Ten Thousand Smokes, Alaska.* Bull. Geol. Soc. America, 1957, **68**, 1585-1604, 13 figs.

A series of specimens of ash and pumice, collected from the throat of fumarole No. 1 of Zies [M.A. 2-166, 439] has been analysed for major and minor constituents and chemical changes calculated. Elements readily converted to volatile chlorides or fluorides were leached near the hot throat but hydrolysis resulted in some late-stage addition in the innermost zone. Appreciable quantities of Pb, Zn, Cu, As, Cl, F, and SO<sub>4</sub> were added to the innermost zone (one inch), and Ni, Co, B, and Sc were concentrated about two feet from the throat. Magnetite, hematite, goethite, hydromica, opal, montmorillonite, and kaolinite are the chief alteration minerals. The alteration is similar to that produced by strong sulphur acids elsewhere, the halogen-acid alteration differing chiefly in the greater loss of SiO<sub>2</sub> relative to Al<sub>2</sub>O<sub>3</sub>.

R. A. H.

**White (Donald E.).** *Magmatic, connate, and metamorphic waters.* Bull. Geol. Soc. America, 1957, **68**, 1659-1682.

Some major types of water of 'deep' origin are believed to be recognizable by their chemical and isotopic compositions. Oilfield brines are believed to be connate in origin, with a varying proportion of meteoric water: the changes which may take place in the composition of sea water after it is



rapped in newly deposited marine sediments are outlined. leanic sodium chloride waters may be distinguishable by atively high Li, F, Si, B, CO<sub>2</sub>, S, As, and Sb, by relatively y Ca and Mg, and by lack of hydrocarbons, water-soluble mpounds, and perhaps ammonia and nitrate. The water belled after rocks have undergone compaction, during gressive metamorphism, is termed metamorphic water. all changes that occur in rocks, from diagenesis to tamorphism, are probably reflected in the interstitial ters, their interpretation is of considerable importance. veral new analyses of brines and of volcanic and thermal ters are tabulated. [M.A. 14-44] R. A. H.

ar (David). *Pumice chronology in New Zealand*. New Zealand Journ. Sci. Techn., 1957, **38**, sect. B, 862-870, 2 figs.

The distribution of conspicuous pumice in rocks of the outh Island, New Zealand, is described, and related to e middle and upper Tertiary and Quaternary stratigraphic ges. Inferred sources for the pumice are described.

W. A. W.

arkhinin (E. K.)] Мархинин (Е. К.). О количестве ювенильной воды участвующей в вулканических взрывах. [On the amount of juvenile water involved in volcanic explosions.] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.R.S.S.], 1958, **119**, 537-539, 2 figs.

The assumption is made that a volcanic explosion occurs en the volume of gas bubbles in the magma reaches the its of close packing conditions, i.e.  $\frac{2}{3}$  of the total volume. en, on the basis of a formula which connects the energy the explosion with the quantities of solid and gaseous bducts of the explosion, the author calculates that a lcanic explosion can occur only when the amount of ter in magma exceeds 0.1 weight per cent. S. I. T.

hilov (V. N.), Belikova (N. N.) & Ershova (Z. P.)] Шилов (В. Н.), Беликова (Н. Н.) и Ершова (З. П.). О применимости метода плавления для определения приблизительного химического состава кайнозойских вулканических пород южного Сахалина. [On the applicability of the melting method to an approximate determination of the chemical composition of Kainozoic volcanic rocks of southern Sakhalin.] Доклады Акад. Наук СССР [C. R. Acad. Sci. U.R.S.S.], 1958, **119**, 326-329, 3 figs.

Eighty-three analysed rocks and four analysed melts were used for the estimation of the applicability of the 'refractive index of glass' method, proposed by W. H. Mathews [M.A. 11-331]. The present authors make an attempt to extend this method to the determination of all principal oxides in rocks and curves are provided for the three series of rocks: calcic, calc-alkalic, and alkalic.

S. I. T.

[Ivanov (V. V.)] Иванов (В. В.). Гидротермы очагов современного вулканизма Камчатки и Курильских островов. [Hydrotherms in the centres of modern vulcanicity in Kamchatka and the Kurile Islands.] Труды Лабор. Вулканологии, Акад. Наук СССР [Trans. Labor. Vulcanology, Acad. Sci. U.S.S.R.], 1956, **12**, 197-217, 9 figs.

Acid sulphur-carbonate thermal waters are described and discussed and it is concluded that they are formed under the influence of fumarolic gases. S. I. T.

[Markhinin (E. K.)] Мархинин (Е. К.). Об энергии образования ювенильного вулканического пепла. [On the energy of formation of juvenile volcanic ash.] Доклады Акад. Наук СССР [C. R. Acad. Sci. U.R.S.S.], 1957, **116**, 826-829, 1 pl.

This is a detailed mathematical treatment as applied to the calculation of the energy of formation of volcanic ash out of an andesite-dacite from Kamchatka. It is concluded that the total amount of thermal energy contained in 1 km<sup>3</sup> of lava at 1000°C is about  $2.5 \times 10^{25}$  ergs, and that the energy of formation of volcanic ash on explosion is about one tenth of the total thermal energy of the lava.

S. I. T.

[Zelenov (K. K.)] Зеленов (К. К.). О выносе растворенного железа в Охотское море гидротермами вулкана Эбеко (о. Парамушир). [On the discharge of iron in solution into the Okhotsk Sea by the thermal springs of the Ebeko volcano (Paramushir island).] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **120**, 1089-1092.

Three rivers fed by volcanic thermal springs discharge acid waters, rich in ferrous iron in solution, into the sea surrounding Paramushir, one of the Kurile islands. On mixing with the sea water the acidity is reduced and ferric iron is precipitated as a dense mass of flocculent matter forming a trail several kilometres in length. The Yuriev river alone supplied 35-50 tons of iron precipitate per 24 hours.

S. I. T.

[**Korzhinsky (D. S.)**] Коржинский (Д. С.). Гидротермальная кислотно-щелочная дифференциация. [*A hydrothermal acid-alkaline differentiation.*] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **122**, 267-270.

Attention is drawn to the postmagmatic combined processes of leaching and deposition of bases. These processes are best explained by a hypothesis, previously proposed by the author, of the "advancing wave of acid component" as a result of a filtrational effect. [M.A. **14-71**] S. I. T.

[**Budnikov (P. P.) & Polinkovskaya (A. I.)**] Будников (П. П.) и Полинковская (А. И.). Исследование вулканических водусодержащих стекол и продуктов их вспучивания [*The study of volcanic water-containing glasses and of the products of their swelling.*] Доклады Акад. Наук СССР [C.R. Acad. Sci. U.S.S.R.], 1958, **122**, 289-292, 2 figs.

Volcanic glasses from the Primorsky region were studied in respect of their suitability for the manufacture of industrial "perlite". Four chemical analyses of acid glassy rocks are given, as well as dehydration and thermal curves. S. I. T.

[**Schuiling (R. D.)**]. *A zircon-study of an augen-gneiss in the Menderes massive.* Bull. Min. Res. Expl. Inst. Turkey, 1958, **51**, 35-38, 3 figs., 1 pl.

By statistical study of a zircon-concentrate obtained from an augen-gneiss of the Menderes massif it has been proved that this gneiss is of sedimentary origin. This study concerned only one sample of augen-gneiss.

P. C. Z.

[**Kouvo (Olavi) & Vuorelainen (Yrjö)**]. *Valleriitista* [On valleriite]. Geologi (Finland), 1959, **11**, 32-33, 1 fig. [Finnish with English summary.]

From the optical properties, X-ray data (tabulated), and characteristic X-ray emission spectrum it is inferred that in most cases the mineral described from some Finnish ore-bodies as valleriite is in fact an iron sulphide. The prominent lines in the X-ray powder pattern correspond approximately with those of kansite,  $\text{Fe}_3\text{S}_8$  (a corrosion product found in Kansas, ASTM X-ray powder data file 7-26). Under the microscope this mineral is almost indistinguishable from valleriite. So far, of the "valleriites" of Finland only that from the zinc ore-body of Vihanti, is found to be identical with the actual valleriite of Kaveltorp. All the

others appear to be the iron sulphide, mentioned above which may also contain traces of nickel and cobalt.

V. M.

[**Ljunggren (P.)**]. *An occurrence of gypsum crystals and jarosite in a gravel hillock, west of Billingen, Sweden.* Geol. Fören. Förh. Stockholm, 1955, **77**, 284-288, 3 figs.

Stones and boulders in the actual gravel material are surrounded by a crust of fine-grained gypsum. Together with the crystals of gypsum are two kinds of earthy minerals: the one of a white colour and the other of a yellowish colour. The white powder was identified with gypsum and the yellow one as jarosite.

E. Å.-n.

[**Ljunggren (P.)**]. *The black beach sands of Iztapa on the Pacific coast of Guatemala.* Fysiograf. Sällsk. Förh. Lund, 1958, **28**, 109-119, 1 fig.

The author has collected and examined representative samples from the large deposits of black beach sand at the village Iztapa on the Pacific coast of Guatemala. Most of the sand grains have a size of 0.5-0.25 mm. The grains are composed mainly of lava fragments and of olivine, quartz, augite, hypersthene, plagioclase, and titaniferous magnetite. Examination of the last mentioned mineral proved a content of about 5% Ti. The magnetite of the black sand originates from mainly basic extrusives, andesites and basalts. The possibilities of economic utilization of the sand, which has a total content of 11% magnetite and a comparatively high concentration of titanium, are discussed.

E. Å.-n.

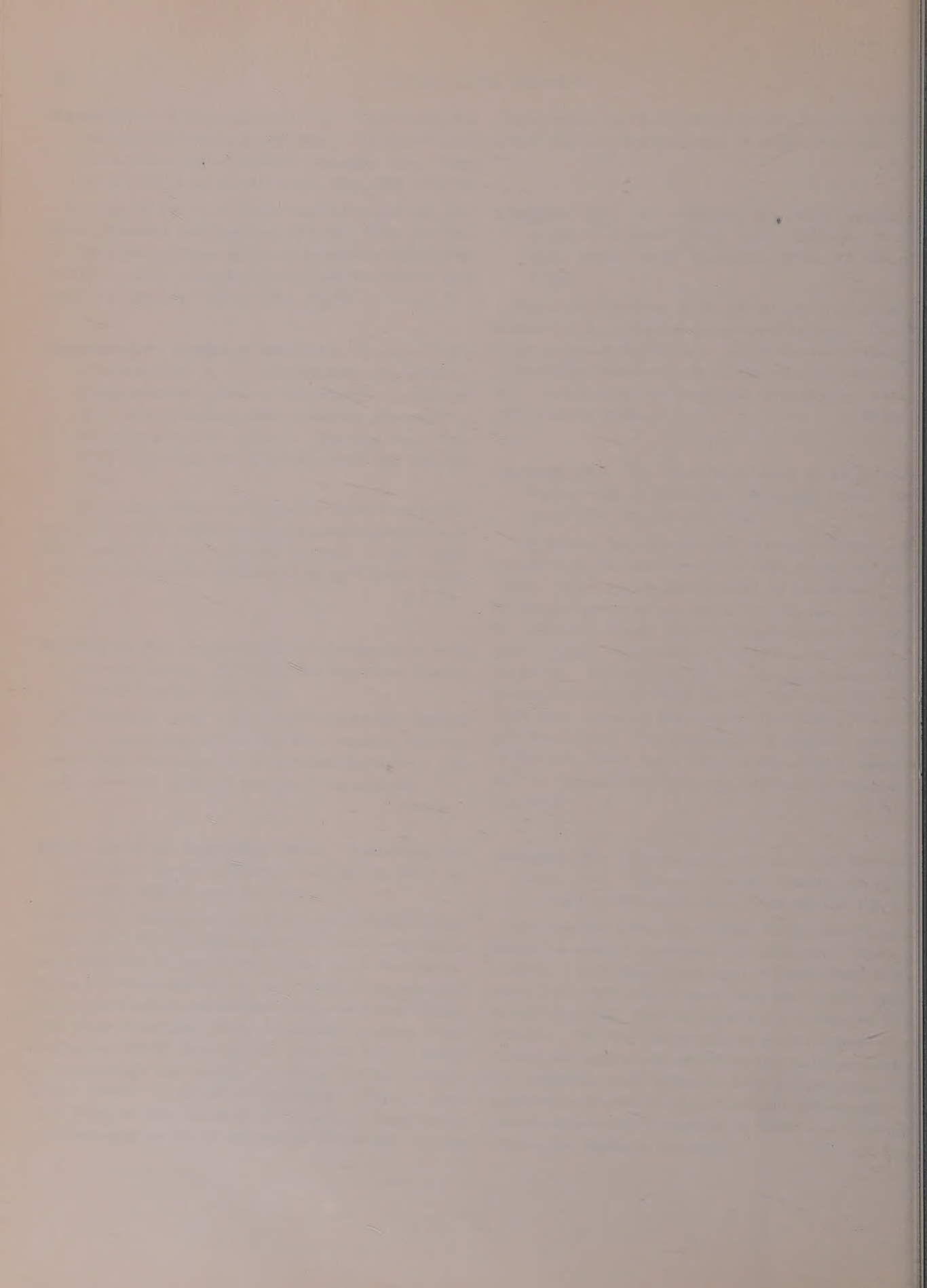
[**Ljunggren (P.)**]. *Mineralogical examination of black beach sands from "Lago de Izabal", eastern Guatemala.* Fysiograf. Sällsk. Förh. Lund, 1958, **28**, 133-139, 1 fig.

Sand samples from four beaches at the lake "Lago de Izabal" in eastern Guatemala are examined. The composition of this black beach sand is quite different from that of the black beach sand from the Pacific coast of Central America. One sample shows a content of 82.6% ilmenite. The other three samples mainly consist of serpentine and have a very low concentration of ore minerals. The serpentine sand emanates from the serpentine belt surrounding the lake on its northern and western side. The possible enrichment of chromite in beach and river sand within this region is discussed.

E. Å.-n.









# ABBREVIATIONS AND SYMBOLS

used in the text of abstracts

M.M. .. Mineralogical Magazine : M.A. .. Mineralogical Abstracts : A.M. .. American Mineralogist

## CHEMICAL & PHYSICAL-CHEMICAL

cation-exchange-capacity .. ..	c.e.c.
differential thermal analysis ..	d.t.a.
equivalent $U_3O_8$ .. ..	$eU_3O_8$
ethylenediaminetetra-acetic acid ..	EDTA
heat of formation (absolute temperature subscript) .. ..	$\Delta H_f$
ionic potential, e.g. .. ..	pH
insoluble residue .. ..	insol. res.
isotopes, e.g. .. ..	$^{40}A$ , $^{40}K$
loss on ignition .. ..	ign. loss
milliequivalent .. ..	me.
microgramme .. ..	$\mu g$
million-years .. ..	m.y.
not determined .. ..	n.d.
not found .. ..	nt. fd.
not present .. ..	nil
parts per million .. ..	p.p.m.
strength of solution, normal ..	$N$
— — — molar .. ..	$M$
substances in ionic state	
anions, e.g. .. ..	$Cl^-$ , $SO_4^{2-}$
cations, e.g. .. ..	$K^+$ , $Fe^{3+}$
valency, e.g. .. ..	$Cl^I$ , $Fe^{II}$ , $Fe^{III}$

## CRYSTALLOGRAPHIC & STRUCTURAL

Ångstrom unit ( $10^{-8}$ cm) .. ..	Å
crystal axes .. ..	$a$ , $b$ , $c$
— face indices .. ..	(hkl)
— form indices .. ..	{hkl}
— zone indices .. ..	[hkl]
indices of X-ray diffractions ..	hkl
intensity, .. ..	$I$
— relative .. ..	$I/I_0$
interplanar spacing .. ..	$d$
mica structural polymorphs ..	$1M_1$ , $2M_1$
Siegbahn units .. ..	kX
space group. These words will be written in full	
unit cell, formula units .. ..	$Z$
— — repeat distances .. ..	$a$ , $b$ , $c$
— — reciprocal lattice lengths of edges .. ..	$a^*$ , $b^*$ , $c^*$
— — interaxial angles	
direct lattice .. ..	$a$ , $\beta$ , $\gamma$
— — — reciprocal lattice ..	$a^*$ , $\beta^*$ , $\gamma^*$

## OPTICAL

dispersion, e.g. .. ..	$r > v$
extinction angle, e.g. .. ..	$\gamma : c$
optic axial angle .. ..	$2V$
— — plane .. ..	O.A.P.
refractive index, in text .. ..	refr. ind.
— — of isotropic mineral ..	$n$
refractive indices	
of uniaxial mineral .. ..	$\omega$ , $\epsilon$
of biaxial mineral .. ..	$\alpha$ , $\beta$ , $\gamma$
sign of biaxiality	
negative .. ..	— or $2V_\alpha$
positive .. ..	+ or $2V_\gamma$

## PHYSICAL (other)

calorie .. ..	cal.
calorie, large .. ..	kcal.
cycles per second .. ..	c/s
degree centigrade .. ..	$^{\circ}C$
density .. ..	$D$ (quote units)
— , relative, e.g. .. ..	$D_4^{20}$
gramme .. ..	g
hardness .. ..	H.
melting-point .. ..	m.p.
micron ( $10^{-6}$ cm) .. ..	$\mu$
millimicron ( $10^{-7}$ cm) .. ..	m $\mu$
pounds per square inch .. ..	lb/in $^2$
soluble .. ..	sol.
specific gravity, terms of reference not known .. ..	
known .. ..	sp. gr.
wavelength .. ..	$\lambda$

## SYMBOLS

approximately equal to .. ..	$\approx$
equal to .. ..	$=$
equal to or greater than .. ..	$\geq$
equal to or less than .. ..	$\leq$
greater than .. ..	$>$
less than .. ..	$<$
not equal to .. ..	$\neq$
parallel to .. ..	$\parallel$
per cent. .. ..	%
per mille .. ..	$\text{‰}$
perpendicular to .. ..	$\perp$
proportional to .. ..	$\propto$



## Mineralogical Abstracts

The Mineralogical Society of Great Britain and the Mineralogical Society of America are the joint publishers. The periodical can be obtained directly from the Publications Manager, Mineralogical Society, 41 Queen's Gate, London, S.W. 7, or through any bookseller.

*Annual Subscription* for one calendar year of four issues : U.S. \$9 or £3 3s. post free.

*Back Numbers* : volumes 1-13 of *Mineralogical Abstracts* were issued only with the *Mineralogical Magazine* (volumes 19-31) and are not available separately. With the exception of a few which are out of print, back numbers of the *Magazine* containing *Abstracts* are available at U.S. \$3.50 or 25s. per number.